ROADMASTERS' CONVENTION NUMBER

Railway Maintenance Engineer

Volume 17 CHICAGO—OCTOBER, 1921—NEW YORK Number 10

Combined with their feature of strength—which under actual test has been proven many times stronger than the cast metal—Q & C Rolled Steel Compromise or Step Joints embody the factors of safety and economy. By our process of manufacture a rolled steel joint with the Bonzano and Thomson features (the strength giving depending flange and metal distribution at the head) is pressed to fit any rail section. This process involves heat treatment which further strengthens the joint and also permits pressing to a perfect fit. On your road you want the step joints that are most efficient.

A card will bring you any information. Write us today

THE Q & C CO.

RAILWAY EXCHANGE BLDG., ST. LOUIS.

90 West St., New York

PEOPLES GAS BLDG., CHICAGO.

INTERNATIONAL
STEEL CROSSING FOUNDATIONS
vs. HEAVY DRIVERS
When the 8,000 pound moving load of each big driver of a heavy locomotive bumps over the flangeway of a crossing supported on a Steel Crossing Foundation even a section hand can see the difference. The racking, twisting shocks are absorbed by the oak timbers and spread over the ballast on more square feet of bearing than can be obtained in any other way.
International Steel Crossing Foundations are now being built heavier throughout. They are riveted with ¾" rivets; filled with hard oak timbers and have a proven fastening method. All plates are ½" thick and the channels are 7" x 14.75 pounds.
If your road cannot specify now, recommend the use of Steel Crossing Foundations to intersecting Electric Railways who must save money.
A proposal plan will be sent on request.

The International Steel Tie Company

CLEVELAND, OHIO

RAILWAY MAINTENANCE ENGINEER
Entered as second-class matter June 23, 1916, at the post office at Chicago, Ill., under the Act of March 3, 1879. Published Monthly by Simmons-Boardman Publishing Company at 608 S. Dearborn St., Chicago. Subscription price, United States, Canada and Mexico, $3.00 a year; foreign countries, $5.00 a year.

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Put your Difficult Problems up to Them

WHEN a difficult explosives problem presents itself, bear in mind that you have at your command a corps of men whose business is to solve it.

These Du Pont field men have spent years in specializing on just that sort of work in every kind of explosives operation under almost every conceivable condition.

They are constantly in touch with the latest developments in the laboratory and in the field.

They have saved users of Du Pont Explosives hundreds of thousands of dollars.

Service at the point of use, such as these men supply, is backed up by a nation-wide system of distribution and delivery; by a control of manufacture assuring uniformly high quality; by a technical staff constantly discovering and incorporating improvements in product— this constitutes Du Pont Explosives Service— and it is at *your* command. Write or wire our nearest branch office.

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Du Pont Products Exhibit
Atlantic City, N. J.

E. I. du Pont de Nemours & Co., Inc.
Sales Department: Explosives Division
WILMINGTON, DELAWARE

EXPLOSIVES ~ SERVICE

AIRCO OXYGEN AND ACETYLENE SERVICE

IS GOOD SERVICE

AIRCO

Good Oxygen and Acetylene Service

prevents loss of time and misunderstandings, and insures the operator being free to think about nothing but the success of his work. Airco has the distributing stations to provide good oxygen and acetylene service.

Air Reduction Sales Company

Manufacturers of Airco Oxygen, Airco Acetylene, Airco Welding and Cutting Apparatus and Other Airco Products

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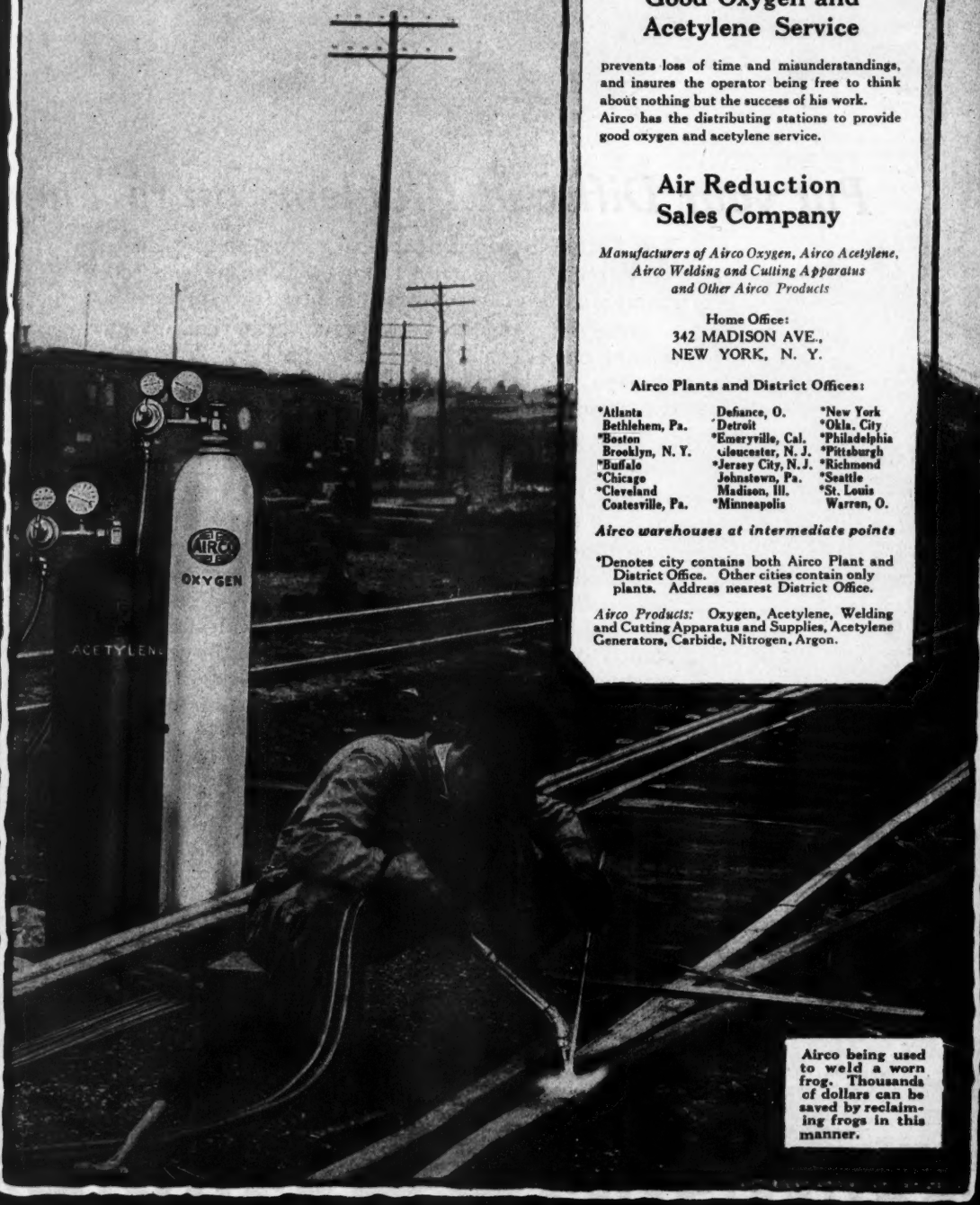
*Atlanta	Defiance, O.	*New York
Bethlehem, Pa.	*Detroit	*Okla. City
*Boston	*Emeryville, Cal.	*Philadelphia
Brooklyn, N. Y.	Gloucester, N. J.	*Pittsburgh
*Buffalo	*Jersey City, N. J.	*Richmond
*Chicago	Johnstown, Pa.	*Seattle
*Cleveland	Madison, Ill.	*St. Louis
Coatesville, Pa.	*Minneapolis	Warren, O.

Airco warehouses at intermediate points

*Denotes city contains both Airco Plant and District Office. Other cities contain only plants. Address nearest District Office.

Airco Products: Oxygen, Acetylene, Welding and Cutting Apparatus and Supplies, Acetylene Generators, Carbide, Nitrogen, Argon.



Airco being used to weld a worn frog. Thousands of dollars can be saved by reclaiming frogs in this manner.

Send for the Airco Frog Welding Booklet entitled, "An Airco Achievement." Mention Railway Maintenance Engineer when writing.

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Snow Plows.
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Standard Tee Rails.
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Pittsburgh-Des Moines Steel Co.

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Wood Shovel and Tool Co., The.

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International Steel Tie Co.

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Weir Frog Co.

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Tie Plates.
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Lundie Engineering Corp.
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Tie Rods
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Tie Spacers.
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Air Reduction Co., Inc.

Torches, Blow Acetylene.
Air Reduction Co., Inc.

Torches, Blow Combination.
Air Reduction Co., Inc.

Torches, Welding Acetylene.
Air Reduction Co., Inc.

Torches, Welding and Cutting.
Air Reduction Co., Inc.

Track Drills.
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Track Insulation.
Diamond State Fibre Co.

Track Jacks.
Duff Manufacturing Co.
Verona Tool Works.

Track Material.
Ramapo Iron Works.
Weir Frog Co.

Track Mowers.
Rawls Machine & Mfg. Co.

Track Pans.
Des Moines Bridge & Iron Co.
Pittsburgh-Des Moines Steel Co.

Track Scales.
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Track Tools.
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Trestle Slabs.
Massey Concrete Prod. Corp.

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Varnish, Electrical Insulating.
Ruberoid Co., The.

Washers.
Diamond State Fibre Co.

Water Column.
American Valve & Meter Co.

Water Crane.
American Valve & Meter Co.

Waterproofing.
Minwax Co., Inc.
Ruberoid Co., The.

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Golden-Anderson Valve Specialty Co.

Water Tanks.
Des Moines Bridge & Iron Co.
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Wheels (Hand and Motor Car).
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Wire.
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Wire Rope.
Fairbanks, Morse & Co.

Wood Preserving Oil.
Republic Creosoting Co.

Wood Working Machinery.
American Saw Mill Machinery Co.

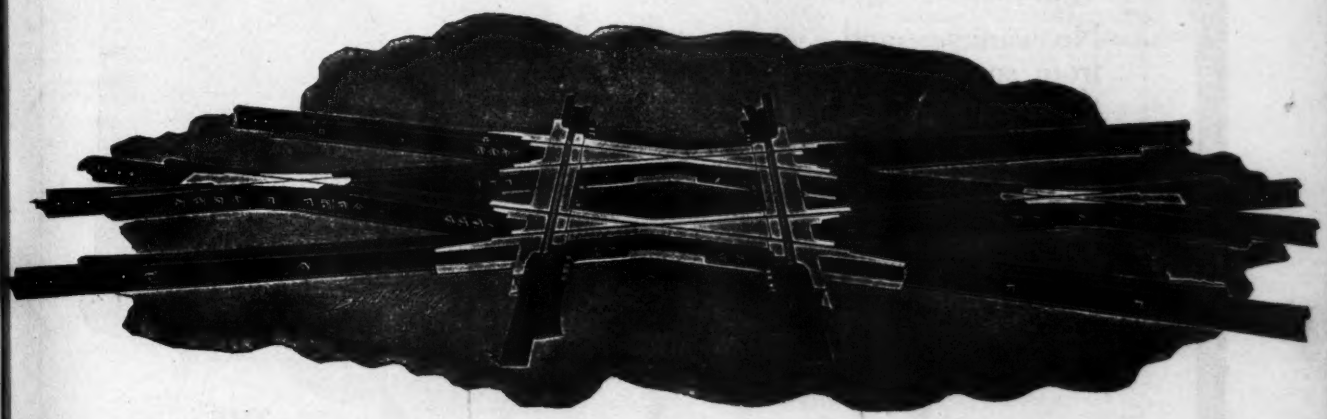
Wrecking Cranes.
Bucyrus Company.

Special Trackwork

FROGS, SWITCHES, CROSSINGS

MANGANESE STEEL
and plain rail constructions

This illustrates the economy of WHARTON Special Trackwork, made of "TISCO" Manganese Steel.



Furnished the M. K. & T. Ry. for their line over the Frisco System at Columbus, Kansas, to replace a Wharton crossing of the same construction in use over 13 years.

WM. WHARTON JR. & CO., INC.

EASTON, PENNSYLVANIA

Subsidiary of Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

Carbic

AUTO-FEED

Of the Special Carbic Cake

And Uniformity

of Gas Pressure

Are only two of the many good reasons why most railroads have standardized on

CARBIC LIGHTS

Consult the diagram—the water touches only the bottom of the lowest cake. If the valve is closed, the generated gas depresses the water and "gas making" absolutely stops. When valve is open, the water rises again to the bottom of the cake and "gas making" goes on.

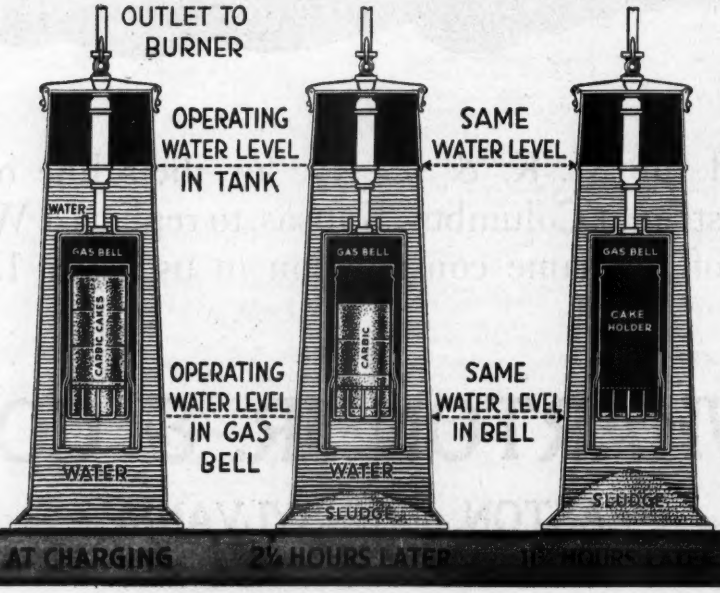
No wastage—and a steady, bright light, free from smoke and soot—but why not ask for the whole story?

Carbic Manufacturing Company

Duluth, Minnesota

New York: 141-149 Centre Street **Chicago: 111 West Washington Street**
Boston: 27 School Street **Philadelphia: 18 South Seventh Street**

Representatives and Stocks in all Principal Cities



THE Carbic SYSTEM

WHEN EAST MEETS WEST

To talk Appliances

THE fuss and frills of every convention lend color and zest to the occasion; but after all, coming right down to brass tacks, practical Maintenance of Way Engineers are interested in time and labor saving devices which will effectively reduce costs.

The Reading Reversible Rail Bender was designed primarily with this in view, for it combines a right and left bender in one and enables the Maintenance of Way Departments to make their own guard rails and stock switch rails.

Other Reading Specialties representing the last word in track devices are:

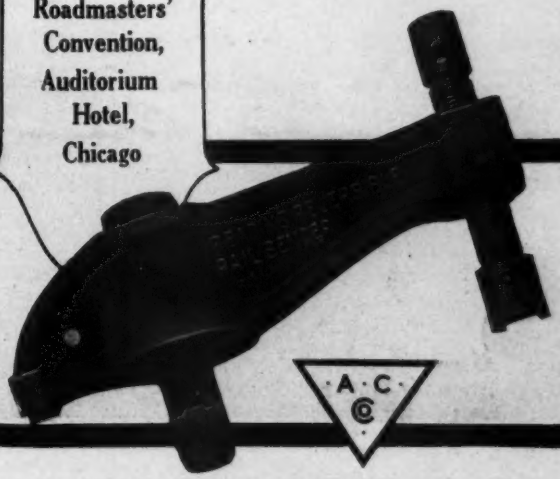
Car and Engine Replacers,
Car and Engine Replacer Clamps,
Compromise Joints,
Guard Rail Clamps,
Tie Spacers,
Derails,
Car Chocks.

READING SPECIALTIES

See our Exhibit

at the

Roadmasters' Convention, Auditorium Hotel, Chicago



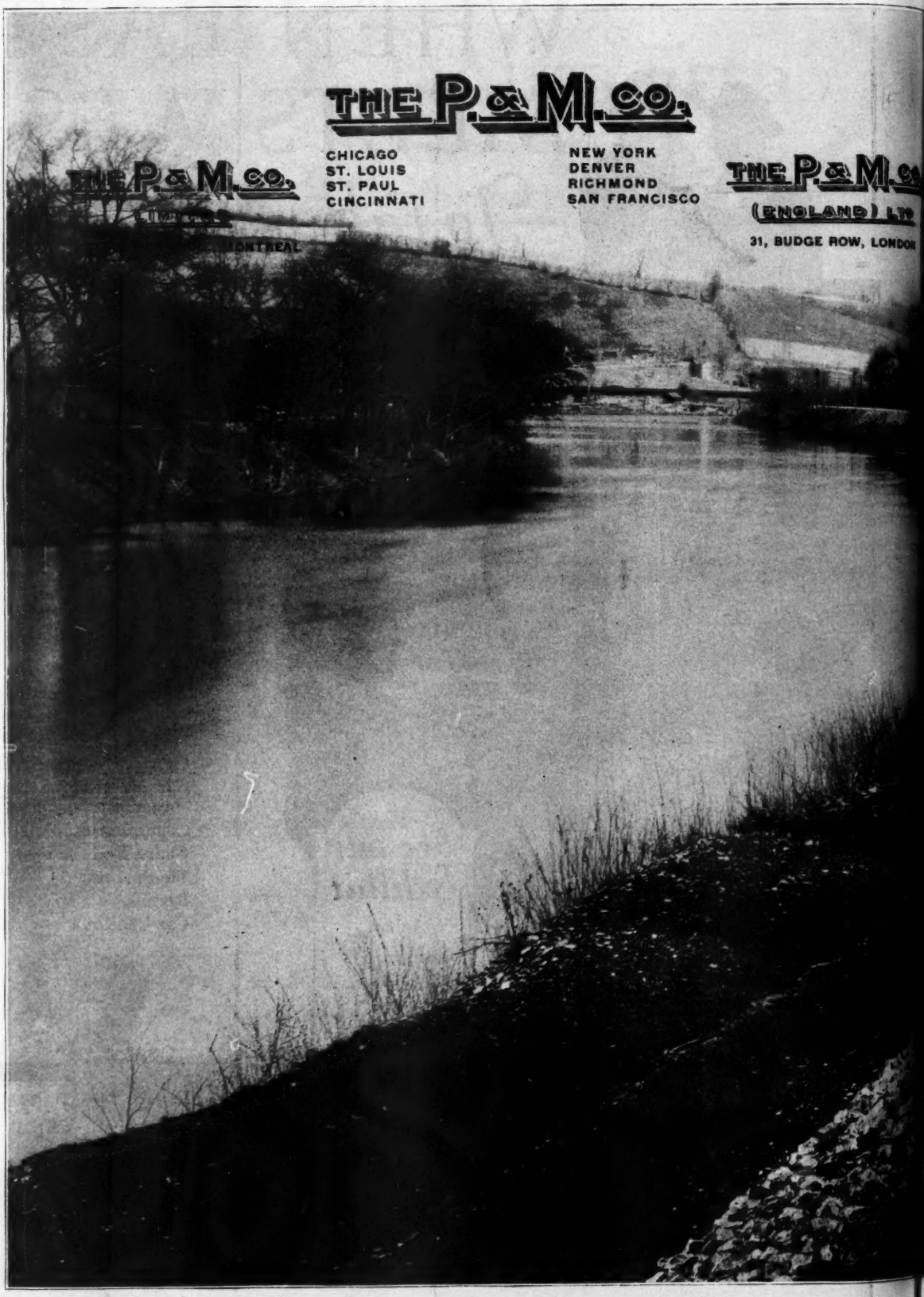
American Chain Co., Inc.

Reading Specialties Div., Dept. RS5

General Sales Office:
Grand Central Terminal, New York City

District Sales Offices:
Chicago, Pittsburgh, Boston, Philadelphia, Portland, Ore. San Francisco

A·C·C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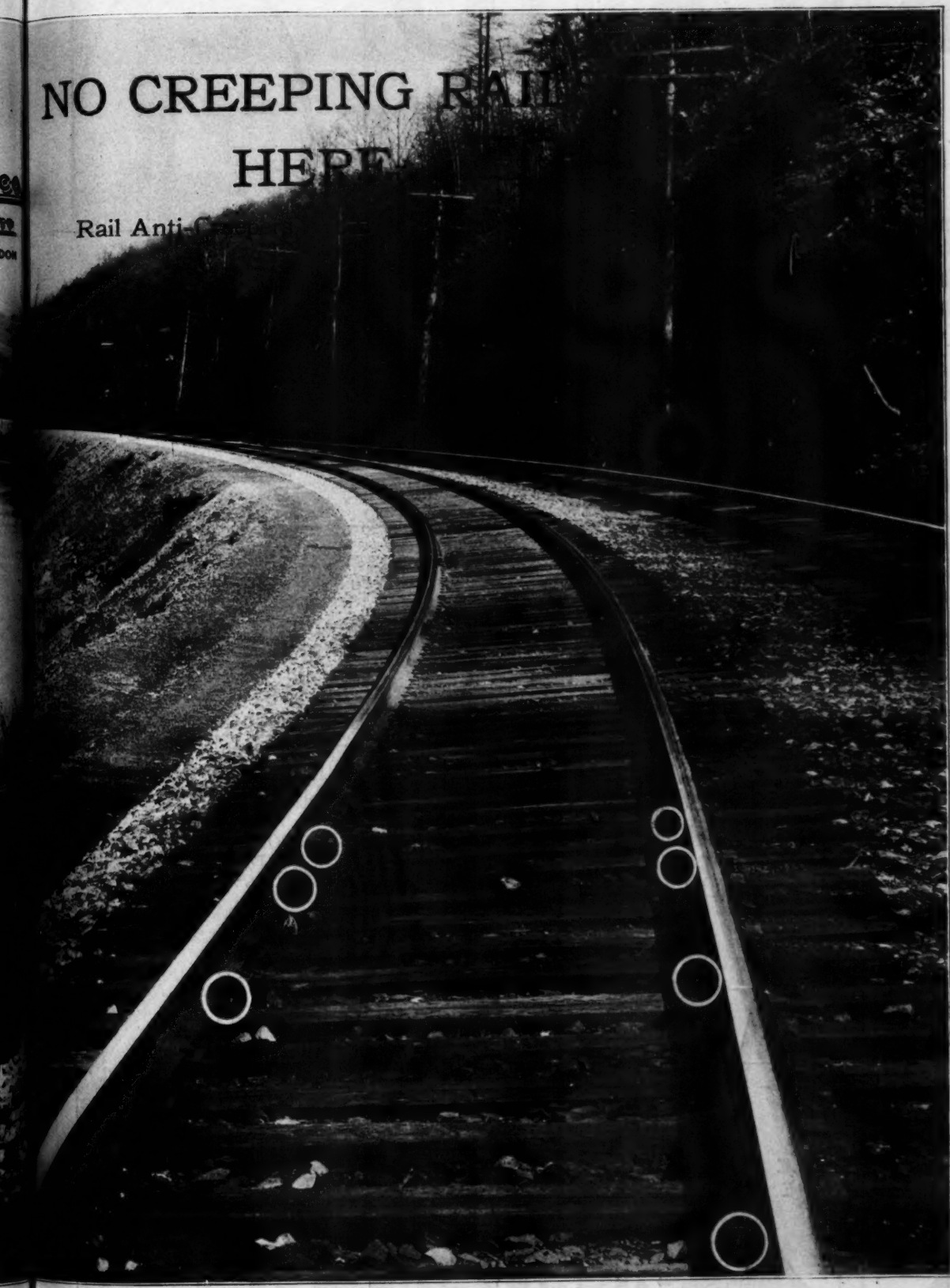
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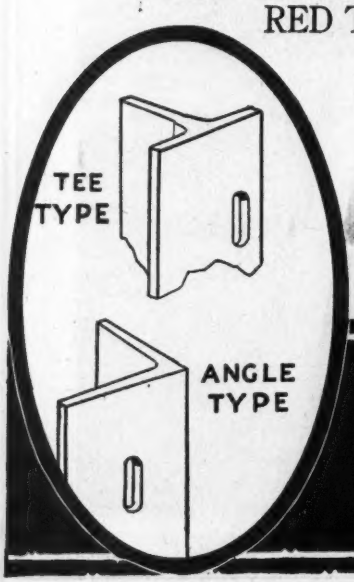

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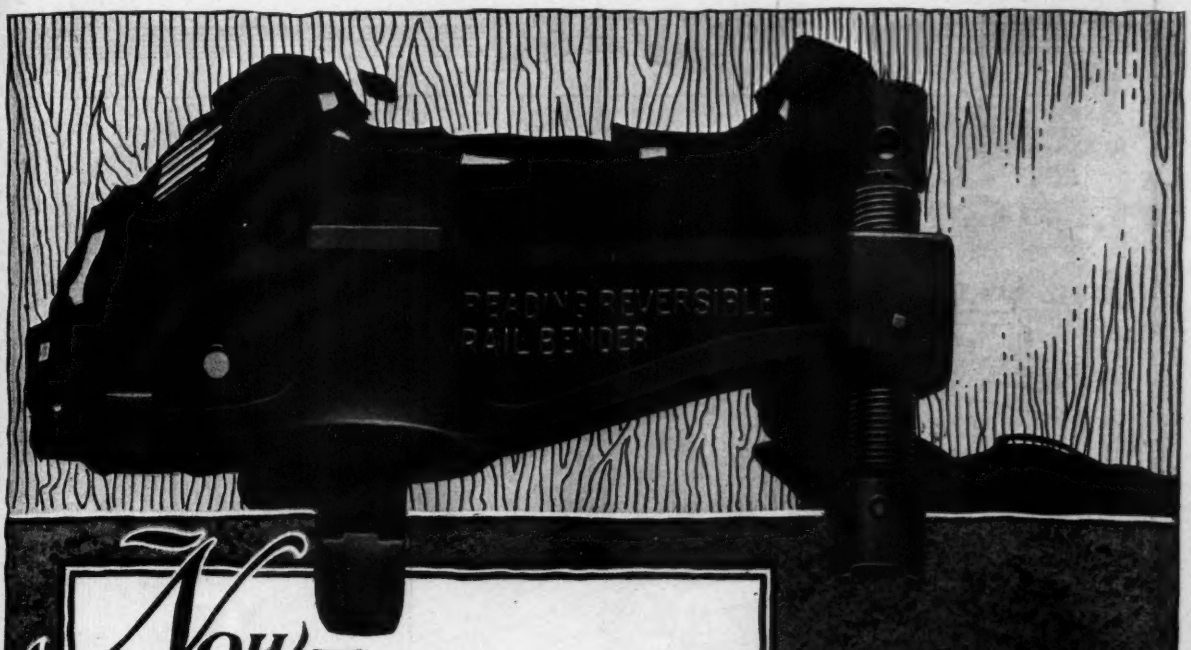

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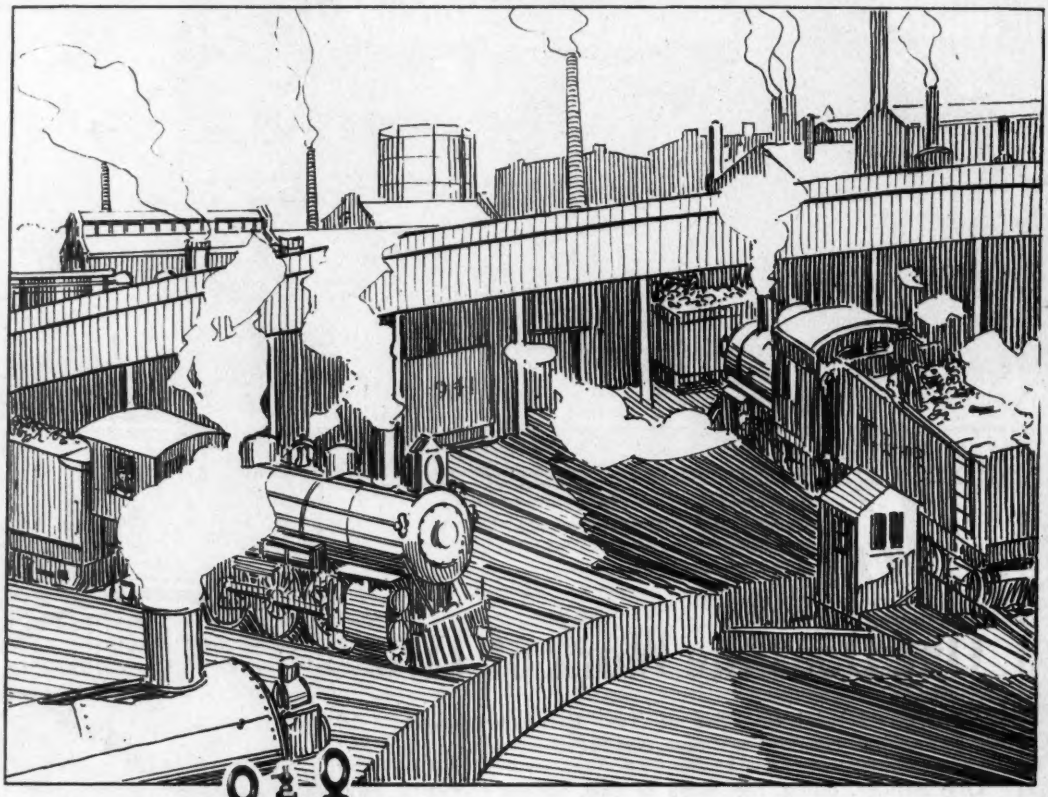

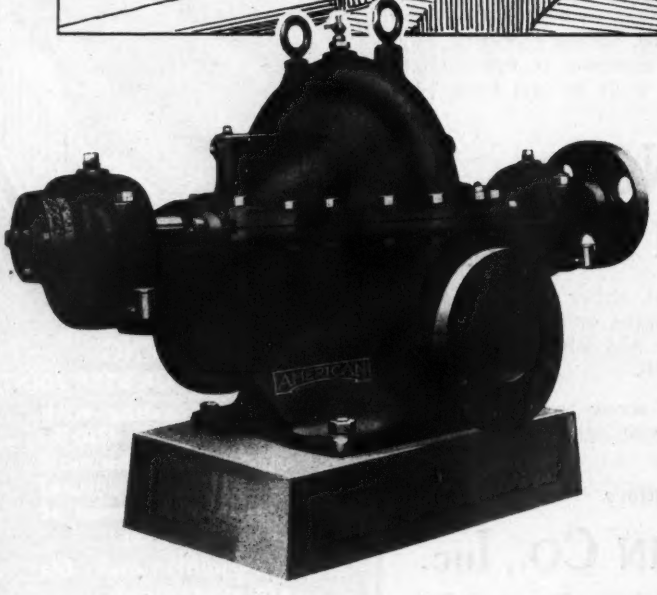

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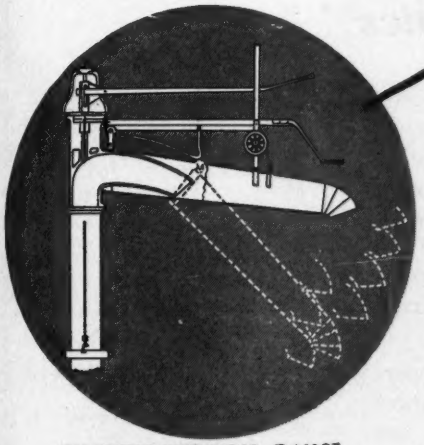

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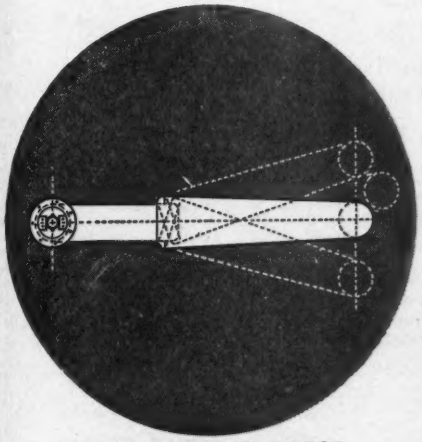

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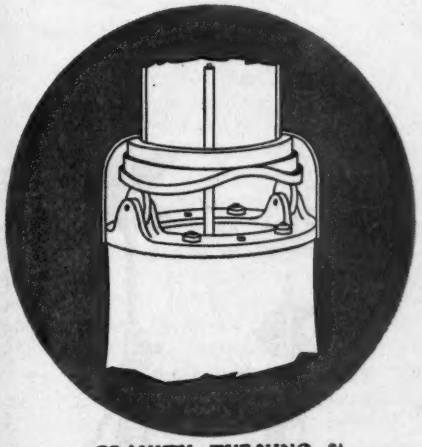

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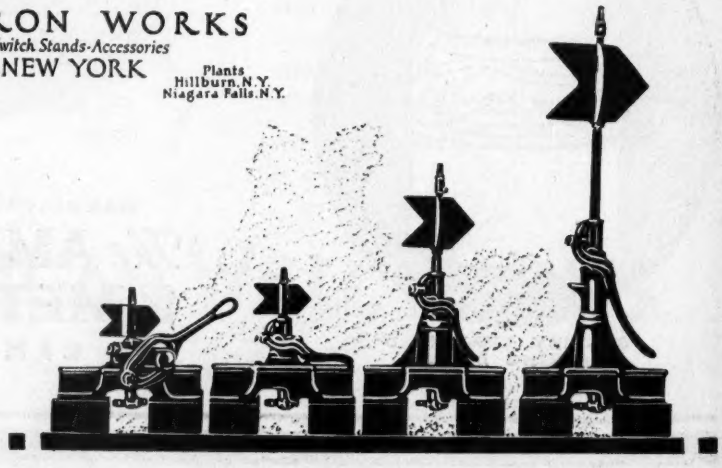

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Lost motion, whether in a gang or in a machine, is an indication of waste. The best remedy for lost motion in the handling of men is a program of work. When a man knows in advance what he is to do when he completes the task on which he is then engaged, he naturally proceeds to that work without hesitation or loss of time. As Mr. Morse pointed out in his paper which was presented before the Roadmasters' Association and which is abstracted on another page, a budget is simply an orderly means of preparing a program by means of which the money available in any period is allotted to the work to be done in the order of its importance. It is an accurate way of spreading the money over the requirements in the way to accomplish the greatest results. A budget is generally considered from the standpoint of a railway system, yet the idea is equally applicable to the division, the sub-division or the section. Take the latter, as an example. A certain amount of work has to be done during the season over and beyond the day to day routine policing work. The preparation of a detailed schedule of this work will do much to expedite it and to carry it to an early and economical conclusion. It will eliminate much of the waste occasioned by the running of the gang back and forth over the section. No supervisor can afford to overlook the preparation of a program of work for his sub-division, neither can he afford to fail to co-operate with his foremen in the preparation of similar programs in their more restricted territories and then see that they adhere to them.

Knowing What to Do Next

The Roadmasters Association has been given an added impetus during the past year through the formation of several local clubs of maintenance of way officers. These organizations are designed to supplement, rather than duplicate, the work of the national organization. In no sense is there any thought of competition between the local and national bodies. Because of the great distances which must be traversed in attending the national meetings they cannot be held more often than once a year. The local clubs afford an opportunity for more frequent gatherings and sustained interest throughout the year. In the local associations, formed thus far, men who have been identified prominently in the work of the Roadmasters Association will be noted among the officers of the local clubs, but one advantage of the smaller organizations is the opportunity it affords for eliciting discussion and comments from men who are not given to public speaking. This is one obvious advantage of the smaller organization. To the Roadmasters Association the prime opportunity for benefit lies in the fact

The Local Maintenance of Way Clubs

that the local club may well serve as a stepping stone to membership in the national organization. Members of the Roadmasters Association who have also joined the local clubs should not lose sight of the opportunity afforded them for adding to the membership of the national organization.

There Is a Hard Winter Ahead

It is common knowledge that the first cold wave interferes with railway operation to an extent out of all proportion to the severity of the storm. This is due in large measure to the fact that the maintenance of way and other forces are caught unprepared. Equipment is lacking or in need of repair, men have not been schooled in the duties they are to perform and other evidences of unpreparedness come to light. Such conditions are a reflection on the officers responsible for the conduct of these operations and are a source of heavy expense to their roads. Reports have already been received of heavy snow storms in the northwest—forerunners of others throughout the northern states. There is therefore no time to be lost in completing all necessary preparations to enable the roads to cope with the winter. It is not safe to rely upon the chance of another winter as mild as the last one.

Keep Up to Date

During a recent inspection of some concrete construction in progress on his road, a bridge engineer discovered that the stone which had been delivered on the job was all of a uniform size. Investigation showed that it was not concrete stone at all, but some ballast stone which had been delivered through an error at the quarry. What caused the engineer of bridges the most concern was that the stone had been accepted by the inspector and the resident engineer as entirely satisfactory and that it would have been used in the concrete but for his chance discovery. That the two men responsible for the failure to catch this error did not notice the absence of a uniform grading of the particles of the stone was clear evidence that they were not keenly alive to the exacting requirements of good concrete. Were this an isolated incident, it would be of no consequence, but it points to an all too common lack of contact between those who actually make the concrete and those who have been responsible for the development of improved practice. Those who do the work should make every effort to improve their knowledge of materials, proportioning, mixing consistency and other important phases of concrete making.

Looking Ahead

October, November, December, January, February and March—six months, and the ice and snow of another winter, having melted, will be renewing the supply at many important water stations. That time to be sure is some distance off, too far in the opinion of some perhaps to warrant thinking about. And yet with the passing of each month, the supply obtained last spring becomes less plentiful, not to say less suitable for boiler use, with the result that at those several points where the spring thaw affords the only source of supply and where at the same time, because of the size of the impounding facilities or the extent of the spring flow, the original supply was none too ample, a situation steadily approaches where a delayed thaw or an accident at some other water station, or a heavier traffic, will occasion more or less expense or annoyance from a water shortage unless some plan of conservation is begun early to prevent it. In the knowledge, therefore, that reservoir supplies are now well within their banks and that snowfalls have already occurred to signify the proximity of a season when it may be less convenient, if not more expensive or even impossible, to ascertain the amount of water on hand, the possibility of leakage through the soil, the rate of consumption, etc., it would seem not at all too soon to inaugurate such inspections and lay out such plans as will prevent the occurrence of a shortage altogether, or provide for the most effective use of the remaining supply co-ordinate with the least expense and interference with train movements. Of course, it is true that not all impending water shortages by any means can be prevented by such methods, but it is also true that situations do arise where shortages can be thus prevented or mitigated. In any event the subject merits the water supply man's attention as another field in which the practice of looking ahead is pregnant of attractive possibilities, not only for rendering commendable service to the railways but for the demonstrating of his own efficiency.

Watch the Housing and Feeding

The present is a period of severe, extensive unemployment in many parts of the country. Because of this it is now possible to recruit for maintenance of way work, men of a caliber who ordinarily would not be attracted to employment as so-called common labor. The railroads can readily take advantage of this opportunity to secure men of a higher grade of intelligence and energy if they will make a reasonable effort to do so. During the present scarcity of work, men are not in a position to be over-particular about their employment and surroundings. But men who would be classed above the grades of the hobo, negro, Mexican or foreigner are accustomed to cleaner and more sanitary surroundings than those which suffice for the classes mentioned above. This does not mean that they are fastidious, but they have been trained to abhor filthy conditions. Dirty dishes, swarms of flies and insanitary sleeping accommodations will drive these men away from the work and the railroads will lose the advantage of their services through inattention to details that the supervising officer would note readily if he would take the trouble to see them. Much will be gained if the supervisor will arrange to eat a meal in the camps occasionally.

THE ESSENTIALS COME FIRST

IN SPITE of the serious curtailment of track forces, adherence to the standards of maintenance have been insisted upon, many times under circumstances that have tried the mettle of the supervisory forces. This is as it should be, for the condition of the track and roadway at the beginning of the year was far below normal. Even with the work that has been performed during the season in improving the roadbed, it is still below its usual standard.

Pumping ties, low joints, worn rail, dirty ballast and other discrepancies are still in evidence. It is hardly possible that all of these defects can be remedied by the time of the annual inspection which is now approaching on many roads. For that reason it should be impressed upon the supervisory officers on these and other roads that while it is highly desirable to have well-appearing track at this time, it is far more important that the really fundamental details of track improvement be carried out conscientiously and thoroughly. In this way only can good riding track be had in a more permanent form. Time spent in cleaning ballast and giving slight raises, followed by a light dressing of new ballast, is well spent and will give good riding track of pleasing appearance. However, it

will not be possible to go over the entire track in this manner. Thus, in order to present the kind of track at inspection time that would be demanded under more normal circumstances, some forces are being permitted, either knowingly or unknowingly, to slight the fundamentals. Instead of cleaning a part of the ballast thoroughly, for instance, far greater stretches are being dressed up by merely disturbing the surface sufficiently to allow the dirt to settle out of sight. The first and only consideration at inspection this year should be to see that the essentials have been completed so far as it was humanly possible to do with the money available.

A TEMPORARY OR A PERMANENT SAVING

AS THE railways are now approaching the end of their active season for maintenance of way work, they are confronted with the problem of changing their forces from a summer to a winter basis. With the continually increasing necessity in recent years for the strictest control over expenditures, it has become the quite general practice to lay off a large proportion of the men with the arrival of cold weather, retaining only the minimum number necessary to take care of the routine work from day to day. There has been an increasing feeling among maintenance men of late that this practice has been carried too far and that it has been responsible in large measure for some of the present handicaps under which this department is laboring. One immediate outgrowth of the drastic reduction in forces has been to add to the accumulation of work which must be done during the relatively short summer working season.

Even a superficial investigation will show that a considerable amount of work can be done to almost if not equal advantage during the winter. Obviously any such work completed during this season reduces the summer peak load to that extent and makes possible the utilization of permanent trained employees, rather than the temporary service of unskilled men. Even more important, it makes it possible to offer a permanent all-the-year-round position to more men, holding them in the service and reducing the labor turn-over, the greatest tax on efficiency today. Nothing has done more to drive the better class of men out of maintenance of way work than the hire-and-fire methods of the past. The man worth while desires permanent work and will seldom submit to being laid off more than once if other work is available. For the first time in several years the roads can now exercise a selection in recruiting their forces and can secure the best men which they have had for a decade. The extent to which they can hold these men when work becomes more plentiful will be determined largely by the treatment they receive during the next 60 days. Those men who are given employment throughout the winter will naturally be influenced to look on railway work as attractive, while those who are laid off will of necessity regard it as of a temporary character.

The Foreman

I know that no man is really happy unless he has a job that he likes. I realize that if I am to succeed, I must believe that my work is worth while and that the officers of my road are doing their best to make a success of it. I feel that my selection as a foreman is an indication that my interest in my work and my efforts have been noticed. But I realize that it means even more. It shows that my superior officers believe I am one who can be depended on to protect the company's interests—to be fair with my men but to secure an honest dollar's worth of work for every dollar paid them. It is my endeavor to be true to this trust for I have a good job on a good road—a part of the greatest transportation system in the world.

LETTERS TO THE EDITOR

THE BASIS OF OUR EFFICIENT FORCE

Osmond, Neb.

TO THE EDITOR:

A great deal has been said relative to the inefficiency of the present day track laborer. We are told by able maintenance men that we cannot hope to secure as efficient track laborers as were employed 20 to 30 years ago. If this is true why is it? Are not men as physically able to do an efficient day's work now as they ever were? Do not the men of today display as much ambition as the men of former times? And is it not a fact that the average man of today is actually in possession of a higher standard of education than were the men of 20 to 30 years ago?

Education teaches progressiveness and to progress we must be efficient. I believe that it is generally conceded that the professional business and trades-men of the present day have made vast advancements in their particular vocations. Therefore is it not reasonable to believe that the laborers have advanced correspondingly?

I am quite sure that if we place the incentive before the present day track laborer he, being physically able, will produce quantity, and being better educated, will also produce quality, and the quantity and quality of work produced are the foundation of efficiency. Therefore I am very much of the opinion that if the incentive in the form of adequate wages and steady employment is placed before the laborer of today, our railroads will in a very short time perceive some very gratifying results.

Now that practically all of the roads have adopted the use of the motor car, I sincerely believe that by making a slight reduction in the number of men usually worked on the sections during the summer months and by retaining the full gang throughout the year, within a very few years an enormous saving would be made, our railroads be maintained on a higher standard, and our labor as well as our foremen problems would be solved.

I believe that an arrangement of this kind, after continuing in effect one or two years, would eliminate the necessity of fence gangs, and also the largest per cent of surfacing gangs, which would effect a big saving in the maintaining of outfit cars and bunk houses. Steady employment and prospects of a foremanship would be an incentive for men to do good work and would enable the supervising officer to have the work done at the time of year most suitable to the various classes of work, which is essential in the economical maintaining of track.

RAY HURLBUT,
Roadmaster, Chicago, Burlington & Quincy.

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Large Trees Anchored to One Or More Concrete Piles Stop the Scour Very Effectively.

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THE Missouri river is like an enormous snake that is perpetually wiggling its way downstream. This progress of its winding course is accomplished only through the sacrifice of an enormous tonnage of rich soil and many acres of valuable real estate that are washed out at the cutting banks to be redeposited further down stream or carried on into the Gulf of Mexico. Owners of property along the Missouri and lower Mississippi and other streams of like characteristics have lost millions of dollars in property destroyed or in money spent in attempts to ward off the incessant attacks of the river currents. The railroads have been among these sufferers where their tracks occupy the river banks, and they have resorted to a variety of methods in their efforts to save their tracks from destruction.

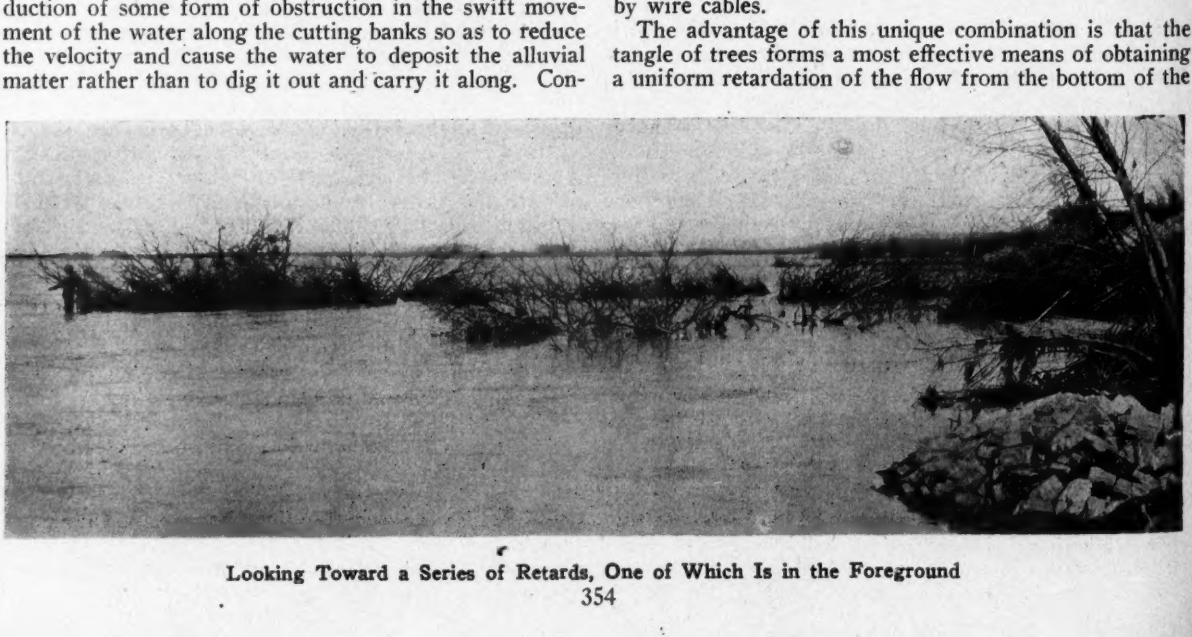
Two general plans have been followed on all river bank protection work. One is to slope off the cutting bank of the river and cover it with a coating that is more or less proof against erosion, such as willow mattresses, riprap, concrete pavement and the like. This class of protection is expensive but serves the purpose for a time. However, most types of this form of protection, which is commonly known as revetment, have eventually experienced breaks in the continuity of the covering which soon lead to the formation of pockets in which the rapidly eddying water soon effects a progressive destruction of the revetment.

The other general type of protection implies the introduction of some form of obstruction in the swift movement of the water along the cutting banks so as to reduce the velocity and cause the water to deposit the alluvial matter rather than to dig it out and carry it along. Constructions of this type which have been utilized include pile dikes interwoven with brush, bank heads, jetties, wing dams, etc. While such methods are generally cheaper than revetment work they are usually less permanent, being subjected to erosion from eddying, or crushing by ice floes. An essential difficulty with this type has been an inability to obtain secure anchorage out in the stream to hold any part of the retarding work at a sufficient distance from the bank to be truly effective.

This deficiency has been overcome in a new form of current retard by the use of the Bignell concrete pile. This concrete pile has had previous application to bridge construction where conditions favored or demanded the jetting of the piles. It consists of a concrete shaft in which a system of pipes are imbedded for the purpose of providing an outlet from the bottom of the pile to afford the necessary jet of water to cut out a hole for the pile ahead of the point, as well as a series of small openings in the four faces of the pile to emit water for lubricating the planes of contact between the pile and the ground through which it is driven. The bottom and side jet pipes are entirely independent so that the water pressures in the two systems may be maintained independently to whatever intensity is required for the requirements.

Because of the complete provision made for cutting and lubricating, these piles are driven with comparative ease. A pile suspended from a fall line with suitable hose and pipe connections to the jet pipes will sink of its own weight and may be buried many feet below the ground surface or stream bed. These piles were first used in river bank protection work for anchoring current retards comprising rafts of timbers as described in the *Railway Maintenance Engineer* for February, 1920, page 67, but this type of protection has been superseded by a more ingenious design in which a tangle of trees is anchored to the piles by wire cables.

The advantage of this unique combination is that the tangle of trees forms a most effective means of obtaining a uniform retardation of the flow from the bottom of the



Looking Toward a Series of Retards, One of Which Is in the Foreground

river to the water surface and from the shore out for the necessary distance to protect a reasonable length of the banks downstream from the retard. This form of construction is most flexible in its adjustment to irregularities of the contour of the river bottom, and can be constructed so as practically to eliminate eddies. The anchorage is secure against scour since the anchor piles are driven far below the bed of the stream and offer no obstruction to the current necessary for the formation of eddies. The anchorage can be placed any where in the channel of the river as required to obtain the most effective guying of the mass of trees.

The construction of this form of current retard is relatively simple. The Bignell piles are driven from a barge equipped with a suitable derrick for holding them in an upright position. As many cables are secured to the top of the pile as are deemed necessary, guying the trees and the pile is then jetted down to whatever depth is deemed necessary to keep the top of the pile buried under the deepest possible erosion of the river bottom. Piles only 20 ft. long have been driven to a depth of 76 ft. below the river bottom. Following this, trees are delivered to the site of the work on barges and as groups of these trees are thoroughly secured to the ends of guy lines attached to the anchor piles they are pushed off the barges into the river with the trunks upstream.

A Derrick Holds the Piles Upright

Trees Are Delivered to the Site of the Work on Barges and Anchored to the Piles

One of the photographs shows the appearance of one of these retards with other retards further downstream. The spacing of the retards is governed by the same general principles as controlled the design of a series of retards of other types. Another of the photographs illustrates a case of rapidly cutting banks, while the third photograph illustrates the result secured by the retards where a substantial bar has been formed. Considerable river bank protection of this kind has been done in the Missouri river up and down stream from Omaha, Neb., by Woods Brothers of Lincoln, Neb., who control the patent on the Bignell pile. Work of this kind has been carried out for the Chicago, Burlington & Quincy in the vicinity of Omaha, also north of its Missouri river bridge at Plattsmouth, Neb., and at Rulo, Neb. Retards are also being constructed for the Illinois Central at Council Bluffs and for a number of rural river bank protecting districts as provided for by legislation in a number of states along the Missouri river. The cost of this protection, because of its simplicity, places this type at a considerable advantage in comparisons with other forms.

SOME HINTS ON SNOW FIGHTING

By Charles B. Williams

SOME ROADS in the north undergo their most serious tests in the winter and are tied up and demoralized at times through indolence, unpreparedness or lack of cooperation of the vital departments concerned, namely, maintenance of way and motive power. Money spent for good snow equipment is never wasted; two flangers, a Russell plow for work in cuts or heavy snow falls, a number of snow melters for interlocking plants and terminals, and a spreader comprise the primary equipment needed for handling a storm. A length of hose connected to a light engine with plenty of steam can do wonders on switches, ladder tracks, etc., in large yards.

In the fall the flangers and shovels should be sent to the shops to be thoroughly overhauled. Salt, snow shovels, brooms and snow melters should be distributed, gas tanks should be filled in readiness for the melters and a circular letter sent out to foremen to place all flanger signs and to get the snow fighting equipment in shape. When flangers and plows are returned from the shops the air, cutting blades and levers should be tested to insure proper functioning.

There is only one way to use snow-fighting equipment successfully. Get the flangers out when the storm starts and have the plows ready to go and as long as any high winds or blizzards are reported keep the flangers out on the job, relieving the operators when possible so as to get the maximum service out of these machines. If the flangers are not started soon enough it will be found impossible to keep the road open for regular scheduled trains. The snow will drift and pack on the tracks and the flangers will tend to climb over the rails, thereby causing further difficulty, or the heavy snow may break the springs on the cutting blades.

It is the common mistake on freight lines to add extra locomotives to the trains to help push them through. They will be stalled in the cuts, snow will block the wheels and fires will have to be dumped, thus tying up the road effectively. Flangers should be run ahead of all the freight trains so as to clean up the track for them. Another very important detail is that the maintenance of way department be given preference in engine and crew assignments. They should have the first call and also be given a show for turning the equipment on the turntables instead of trying to rush the regular trains through ahead

of the storm. The main thing is to prepare and co-operate. Each winter is sure to come and with the little added effort much money and time will be saved.

THE EARLY DAYS OF THE ROADMASTERS ASSOCIATION

BY J. A. KERWIN*

Roadmaster, Chicago, Peoria & St. Louis, Springfield, Ill.

IN 1883 a few track men met at the old Sherman House in Chicago to organize an association in which the roadmasters of the United States and Canada might be brought together to discuss the methods of conducting their work on our railroads. This association has maintained an uninterrupted existence since that time so that it is now the oldest maintenance of way association in North America, antedating the American Railway Engineering Association by 16 years. The convention this year will be the thirty-ninth successive meeting.

This organization was at first composed entirely of "spike maul roadmasters," many of whom had come up from section hands. This limitation in membership existed until the association met in Los Angeles in 1900, when members of the engineering department were also admitted to membership.

From the earliest days the Roadmasters' Association has constituted a forum for the active discussion of the important problems involved in the maintenance of railway tracks. In the earlier years the work of the convention was confined to two days with the third given to pleasure. As years went on the organization branched out, committees were appointed and more important subjects were brought before the convention until today there is hardly any line of track work which is not recorded in the proceedings.

In the early days of the Roadmasters' Association few devices were brought before the association, but as the years passed the inquiry, "Have you see the exhibits?" has become more and more common until it is not unusual to see the exhibit hall crowded with roadmasters after sessions, studying the many devices that are brought out to make track work easier for the men and more economical for the railroads. The Track Supply Association is entitled to much praise for the valuable educational work which it has done.

* Mr. Kerwin is the oldest living member of the Roadmasters and Maintenance of Way Association, being a charter member of the organization. He was president of the association in 1904 and again in 1908.

EAST IS EAST AND WEST IS WEST

THERE IS a strange fascination about the Orient as viewed through the eyes of the American or European and unquestionably the chief interest is derived from the fact that Oriental peoples are different. Thus the Chinese are the product of an old civilization possessed of a high power of resistance to the introduction of anything foreign, but the old order changeth, even the Chinese have succumbed to the constant impress of our western ideas.

An American-made switch stand and the Great Wall of China would seem an impossible and incongruous combination. Yet this is exactly what was found recently and transmitted in a most picturesque way in a note written on a post card addressed to an employee of a certain railway supply company. This is quoted below:

"Peking, May 22, 1921.

"The poet said, 'East is East and West is West and never the twain shall meet.' The poet lied. I have today been to the Great Wall, went three hours out from Peking, in a modern train, over as fine a roadbed (steam) as one may find anywhere, to within about 30 min. walk of one section of the wall, then as many hundred miles long as one cares to walk in the four hours there. The Wall was built over 2,000 years ago. The Ramapo switch stands were built at a later date. From one elevation of the wall one may look down and see the camel trains passing back and forth between China and Mongolia, and at another point trains hauled by monster American Locomotive Works hill climbers, over a perfect roadbed equipped with R. I. W. stands. I think the East and West have met." M. G. W.

Every Day
A Track-Walker Makes a Careful Inspection of Every Foot of L. & N. Track
The Track-Walker walks over his entire section, closely scrutinizing every foot of track on road-bed, trestle or bridge; and his special training, long experience and all-seeing eyes enable him to find any weak spot which may exist in ample time to protect all trains.
Every Month
A Bridge Foreman Makes a Careful Inspection of Every L. & N. Bridge
The Bridge Foreman is, necessarily, a man who "knows bridges from start to finish." In addition, he must be a man whose character justifies the responsibility of his position and the confidence of the management in placing this responsibility upon him. No other kind of Bridge Foreman can hold a job with the L. & N.
Every 3 Months
The Supervisor of Bridges Makes a Careful Inspection of Every L. & N. Bridge
Besides passing over all bridges and trestles at frequent intervals and thus giving them running inspection, the L. & N. Supervisor of Bridges stops, gets off and makes direct inspection of every bridge and trestle, thus keeping in personal touch with every structure and, officially informed on conditions in detail.
Every 6 Months
An L. & N. Diver Inspects All of the Under-Water Piling of L. & N. Bridges
The L. & N. divers are sent to all bridges and trestles to examine the under-water portions thereof; these submarine experts examine each and every pile clear to the bottom and find out exact conditions, not only as to piling, but all other foundation work supporting the tracks. This is done twice a year or as often as conditions require.
Every Year
The Bridge Inspector Makes a Careful Inspection of Every L. & N. Bridge
At least once a year, the general Bridge Inspector inspects every bridge. The responsibility for the safe condition of L. & N. bridges centers in the Supervisor of Bridges and Buildings and is shared by the Chief Engineer, the Bridge Engineer, the Superintendent, and other officers in the active management, the required information being obtained through systematic reports of inspections and personal visits.
L&N
A Wonderful Record
of Safety to Passengers—Never a Loss of Life or Injury From Defective Track or Bridges
In all of the forty-one years during which the L. & N. has operated its N. C. & M. division, not a single passenger over this division has lost his life or been injured from accident due to defective bridges or track. It's a wonderful record, one hardly paralleled in the history of the great American trunk lines, one of which this company may justifiably point with pride.

How the Louisville & Nashville Advertises the Efficiency of Its Bridge Inspection and Safety of the Structures in the Newspapers

MAINTENANCE WORK BEING DONE BY CONTRACT

Rail Renewals, Ballasting and Other Extra Gang Operations are Now Being Carried Out Under This System on Several Roads

FEW SUBJECTS are exciting more interest among maintenance of way men at the present time than the contracting of rail renewals, ballasting and other items of their work. A few roads have followed this practice for a number of years, but the compulsory wage rates and working conditions under which the railroads are now laboring give the contracting system certain obvious economic advantages which it did not possess previously. There has, therefore, been an increased interest in this subject and several roads which had not previously conducted any work by contract are now introducing this system in connection with the season's maintenance program. Contracting is now being employed in the conduct of rail and tie renewals, ballasting and the renewal and application of tie plates and rail anchors, and no little thought is being given to means whereby practically all work done by extra gangs can be carried out by contract.

Owing to a general lack of cost data or any detailed specifications prescribing the exact nature of the work to be done, the earlier contracts for track maintenance operations were largely on the cost plus or force account basis. In other words, the function of the contractor was largely that of a labor agent and supervisor with the advantage of a freedom from certain restrictions in the employing of men. However, with the accumulation of experience there has been a tendency to adopt the unit price form of contract. Many of the contractors are now in possession of adequate knowledge concerning costs to enable them to bid intelligently on work that is paid for on the basis of performance and railway officers have had sufficient experience with the contingencies arising in connection with such work so that they are now able to draw up specifications which will clearly outline the character of workmanship expected, and adequately cover those phases of the work over which controversies between a contractor and a railway might arise.

The contracting of maintenance of way work has a number of advantages in addition to those arising from the freedom from restraint in the selection of the men, establishment of a rate of pay, hours of service, etc. The work is awarded after competitive bidding. The contractor has a first hand, selfish interest in the success and economy of the project. He is also free to graduate the rate of pay both of the men and the foremen so as to reward them equitably for demonstrated industry and thereby increase the incentive for more and better work. This is of particular importance in the case of the foreman who realizes that his salary and tenure of service are governed almost solely by performance and very little by established policies, standard rates and seniority, which necessarily play so important a part in employment on the railways. In the case of the unit price form of contract, especially, the men in the organization soon find out that *results* comprise the one requisite for esteem in the eyes of the contractor.

Introduces New Problems

The contracting of maintenance of way work, as in the case of any other innovations, introduces a great many new problems. This is especially true with the unit price basis of payment. In order that both parties to the contract shall receive satisfactory treatment under all contingencies, the provisions in the contract and specifications must be ample to cover all conditions that may arise.

In general, the railroad furnishes all the material used and usually provides the tools and camp cars. The contractor recruits his own men and foremen, with the possible exception of the flagmen. He also feeds and houses the men and maintains the camps. In some cases the railroad assumes the liability for personal injuries or death of workmen, while in other cases the contractor is required to assume all risk and protect himself by suitable liability insurance. The first arrangement is said to have the advantage of greater economy in that the railroad can assume this liability cheaper than the contractor can protect himself through a policy with a casualty company. The second arrangement, however, is more nearly in line with the usual form in handling ordinary construction contract work.

The tools raise an interesting question. The Pere Marquette, which has had considerable experience in contracting of rail renewals and ballasting, has found it best to have the contractor furnish his own tools because of the difficulties of adjusting disputes between the contracting parties as to the number and condition of tools furnished and used. The bunk cars and other equipment used can usually be furnished more cheaply by the railroad, but if the contractor has his own equipment he can have better control of its condition and insure better quarters for his men.

Three perplexing questions come to the mind of any practical railroad man who considers the contracting of any maintenance of way operations for the first time. These relate to the quality of the work, delays to train movements and the safeguarding of traffic. The first involves the opposing considerations of good workmanship and rapid progress. The second concerns the conflict between operations that will either delay the work or delay the trains and one railroad reports dissatisfaction with contracting for this reason. The third arises from the division of responsibility for the safety of the track.

In general, reliance is placed on two provisions. First, the contractor must know his business and be thoroughly acquainted with the requisites for safeguarding traffic and he or someone equally responsible must be in direct charge of the gangs at all times. As a further precaution the railway company invariably furnishes an inspector who passes on the quality of the work done and is directly responsible for the safety of the track for train movements. This inspector is usually recruited from the railroad's maintenance of way organization and is ordinarily a man of supervisor or general foreman's experience. He is placed in direct charge of the flagmen, whether they are in the employ of the railroad or the contractor. In general, the contractor is permitted to cut the track only on specific authority from the inspector, and this rule is rigidly enforced.

The contract system in maintenance raises a special problem in respect to the quality of the work. This is controlled by a number of factors. The roads have exercised considerable care in the selection of the contractors to insure that the work would be done by a practical trackman. In addition, specifications cover the work as completely as possible to stipulate exactly what is wanted. These conditions, together with dependence on an in-

spector who is thoroughly conversant with the requirements of track work, have been found adequate to secure the required quality of work.

PRACTICES ON THE PERE MARQUETTE

The Pere Marquette has practiced the contracting of rail laying, tie replacing and ballasting for several years. All contracts are now awarded on a unit price per mile basis for rail renewing and ballasting and per tie for tie renewals, with a further provision in the case of rail laying of an additional price for each turnout encountered. In rail laying the unit price includes careful adzing and gaging, but ordinarily does not cover uncoupling of the old rails.

This road has also done ballasting by contract to the amount of 100 to 125 miles in the last four years. The material consists principally of pit run gravel, with the exception of 30 miles of washed gravel. The railroad delivers the ballast and distributes it. The raise is a maximum of eight inches. Following a first lift the track is surfaced to take out low spots. The contract work includes all dressing up to the ditch line on either side and the contracts ranged from 10 to 30 miles each. All tie renewals made in the course of the ballasting work were paid for on a unit price per tie. The contractor ordinarily works separate gangs on stripping, tie renewals and ballasting to a total of 80 men.

The respacing of ties in most cases is carried on following the laying of the new rail. The contractor awarded the rail laying is also assigned the work of tie respacing at a price per mile. The contract provides that the railroad will furnish transportation for the men to and from the work, but not for men quitting the work while it is in progress. Free transportation is also provided for coal and other supplies sent to the contractor's plant.

MICHIGAN CENTRAL WORK

The Michigan Central has been a pioneer in this method of conducting maintenance of way work, having contracted ballasting work since 1906. It is also at the present making tie renewals and doing tie respacing by contract in conjunction with the ballasting or rail laying. Although the original contract work was carried on according to the force account method, the ballasting and tie renewals have been conducted on a fixed price method since 1918 and the rail laying and tie spacing were put on a unit price basis during the present year. All details of the work are outlined under the very complete contract and specification forms. Under this contract the railway company furnishes the tools and the outfit cars, transportation to and from work and for fuel used in the camps. The railroad will assume the liability for accidents.

CONTRACT WORK ON OTHER ROADS

During the present year the Chicago & North Western has contracted over 80 miles of rail laying in Wisconsin and Wyoming on the basis of a price per mile complete, including respacing of the ties. The railroad company distributes the rail, but has found it more satisfactory to have the contractor distribute the track fastenings, as this enables him to carry out this work according to his own plan and thus greatly expedite picking up the fastenings when the rail laying is in progress. The railroad furnishes the cars for boarding and lodging the men, but the contractor furnishes all equipment required for feeding and housing. The contractor's men are given free transportation to and from the work from the nearest labor markets. The contract contains a clause providing for the use of the contractor's men on a force account basis for emergency work incidental to train accidents or washouts or for small jobs of surfacing, etc.

The North Western has for several years contracted the removal of wooden water tank tubs. The chief advantage of this plan is that it relieves the railroad of the necessity for retaining men in its carpenter gangs who are skilled in this highly special work.

During the present year the Great Northern has handled considerable of the rail renewals by contract both on the force account and the piece basis, in the latter case paying for the work at a stated figure per foot of track. The piece work has been done for the most part by small gangs working under a partnership or co-operative arrangement similar to that prevailing on station work on construction projects, the amount paid by the railroad for the work being prorated among the laborers. Ballasting is carried on on a like basis, although a portion of the work is being done by the hour. Satisfactory results have also been obtained through contracting on a piece basis for the applying of tie plates and rail anchors, the renewal of worn angle bars and a small proportion of tie renewals.

On the Missouri Pacific contractors have recently completed 50 miles of rail renewals and work is now in progress on 16 miles more. On this road the railroad furnishes the tools and the camp cars and transportation for the men. The railroad also distributes the materials and assumes liability for injury to the men.

A contract was recently awarded by the Illinois Central for stone ballasting from Athens, Ill., to Swanwick, about 22 miles. This work includes tie respacing and the tie plating of all soft wood ties and all ties on curves. The work is also on a unit price basis, with the contractor furnishing all tools, camp cars and equipment.

THE SAFE HANDLING OF BRIDGE AND BUILDING MATERIALS

THE SHORT article which follows received the third prize in a contest conducted by the Southern Pacific for articles by employees on "What is the reason for the large number of accidents caused by handling rails, ties, stringers and other track and bridge material and how to avoid the same." It was written by George Fulick, bridge and building foreman, Victoria division, Southern Pacific, Texas and Louisiana Lines, and was published in the Southern Pacific Bulletin for September, 1921.

Accidents in maintenance of way work are caused mainly by gangs not being properly organized for the work in hand, therefore the men should be impressed at all times with the importance and significance of the work in which they are engaged. Accidents can be largely avoided by properly placing the men. They should be worked in pairs, one experienced and one "green" man together, as by so doing the experienced man will soon educate his associate in the proper and safe methods. The foreman should in all cases personally direct his men in raising, lowering and placing all heavy material, giving the word when it should be moved or dropped, or he should cause this to be done by the most experienced man in the gang. Men become experienced in a very short time if the instructions given them are worded to avoid any unnecessary criticism. Kind words and proper courtesy from the foreman have an excellent effect.

When possible, handle rails with lining bars, shoulder and rail tongs and heavy bridge material with ropes, bars and cant and carrying hooks. This will prevent the men from getting their feet and hands pinched and prevent other personal injuries. The men should be cautioned at all times in regard to unsafe practices and no member of

the gang should be placed in a hazardous position or one that the foreman himself would not care to assume. In addition, the foreman should see that all tools are in safe and good working condition.

My experience has included work on steel, wood and masonry structures, and the operation of pile drivers, both steam and drop hammer, under all conditions and by using the methods suggested above in handling my men for the past 22 years as bridge and building foreman I have never had a serious accident of any kind.

Water Softening Results on Two Railroads

REPORTS that have been compiled by the Missouri Pacific and Illinois Central on the operation of water softening systems during 1920 show that the Missouri Pacific now has 67 softening plants as compared with 47 in 1919, while the Illinois Central has 20 with a number of additional plants under consideration. Of the total number on the Missouri Pacific, 62 are of the lime-soda type while five are of the soda ash type. Of the lime-soda type plants 28 are continuous and 34 are intermittent plants. By means of these plants, which vary in amount of water treated from a few hundred thousand gallons per year to a service in one instance of 255,425,000 gal. and which represent a total investment of $244,201, a total of 1,617,360,000 gal. of water was treated. This is 28.8 per cent of the total of 5,616,865,000 gal. of water reported to have been used for steam generating purposes and only slightly less than the total of 6,556,826,000 reported to have been used for all purposes over the system. As might be expected, the water is obtained from various sources and is of varying degrees of hardness, that obtained from wells ranging from 11 to about 50, while that from creeks ranges all the way from 6 to 93, and in the case of many creeks varies widely in quality throughout the year.

On the Illinois Central the water supplies are obtained from wells and rivers, the number of well and river stations being about equally divided and the water ranging in quality from about 11 deg. hardness to about 45. On this road all of the plants are of the lime-soda type, 11 of which are continuous and 9 intermittent. These plants represent a total investment of $247,801 and during the year treated 1,149,370,000 gal. of water. Of this quantity one plant is reported to have treated 255,021,000 gal., while two others treated in excess of 163,000,000 gal.

The total cost of treating the water on the Missouri Pacific, including the cost of chemicals, 10 per cent on the investment for depreciation and the cost of attendance, maintenance and supervision, was reported as $143,579, a figure which is equivalent to 8.87 cents per thousand gallons. Compared to 8.72 cents as the cost of treating in 1919, 6.57 cents in 1918 and 4.71 cents in 1917, it will be seen that the cost of treating has increased steadily during the last few years, this being attributed to the increasing cost of chemicals and labor. On the Illinois Central the cost of treating was reported as $89,634, which is equivalent to about 8 cents per thousand gallons. This figure is also higher than that reported in previous years.

In return for the expenditure involved in treating the water on the Missouri Pacific, the plants removed 4,517,883 lb. of scale forming matter from the boiler water, a figure which is interpreted to represent a net saving to the company of $481,129, or the equivalent of 197 per cent on the total investment in water treating facilities. On the Illinois Central, 2,547,609 lb. scale forming matter were removed, which interpreted on the same basis as that adopted by the Missouri Pacific represented a net saving to the company of $292,456, or about 120 per cent on the investment.

These figures are attractive under any condition, but become more so when mention is made of the fact that in both cases the saving is intended to represent only the value of the reductions effected in the amount of fuel required by the locomotives, the flue renewals, the amount of flue calking and other running boiler repairs and the time lost by locomotives while undergoing repairs attributable to water, no consideration having been given to the effect of the water treatment on train performance on the road, an item usually mentioned in any discussion on the benefits to be derived from water softening.

CONDENSED REPORT OF RESULTS OF WATER TREATING FOR 1920

Number of Plants	Amount Invested in Treating Facilities	Quantity of Water Treated in Gallons	Scaling Solids Removed in Pound	Gross Annual Saving	Cost of Treating Process	Net Annual Saving
		Missouri Pacific				
67	244,201	1,617,360,000	4,517,883	$624,708	$143,579	$481,129
		Illinois Central				
20	247,801	1,149,370,000	2,547,609	382,684	89,684	292,456

As a matter of interest in this connection attention is called to the following quotation from the Missouri Pacific's report:

"It is estimated that a saving of at least 60,000 tons of coal was effected due to the removal of the scale forming material which would otherwise have been deposited in the boilers. The 4,517,883 lb. of scale removed, averaged into the 750 engines using this water, and assuming that only 25 per cent adhered to the tubes and sheets, would amount to 1,505 lb. per engine, which quantity would form an insulating coating about 3-16 in. thick. Experiments have shown that fuel wasted to heat through this thickness of scale insulation varies from 20 per cent to 30 per cent. It is safe to assume that the 1,123,000 tons of coal necessary to evaporate the 1,617,360,000 gal. of water, would have been increased at least five per cent by using untreated water. At a number of stations where the supply is secured from creeks or rivers, a very large quantity of mud and silt was also removed from the water, the saving from which is not included in the above figures. There is also the large saving in boiler repairs and loss of engine time which would have been caused by this large scale accumulation."

In both reports the figure was arrived at by considering 15 cents to represent the aggregate saving in the items considered which would be effected for each pound of scale forming matter which was removed from the water, the cost of the water treatment being subtracted from the total to obtain the net saving. This value of 15 cents is referred to as a conservative figure for the purpose and represents the equivalent for the year 1920 of the value of seven cents as derived in 1911 and incorporated in the report of the Water Service committee of the American Railway Engineering Association; the cost of renewing a set of flues having increased from the former estimate of $234 to a figure in excess of $600 and the cost of fuel delivered on the tender having increased to a figure of approximately $3.97 from the former figure of $1.93 per ton. The value of seven cents was arrived at by comparing the estimated operating figures of a 106-ton engine, considered to have traveled

45,000 miles during the year and to have consumed 4,500 tons of coal and 7,500,000 gal. of water, the engine having used in the one case water of 20 grains hardness and in the other water of 7 grains hardness.

When using 20 grain water the assumption was made that at the time for flue renewals, the scale would be ¼ in. thick, from which it was concluded that the average thickness of scale would approximate ⅛ in., which, according to results obtained from tests conducted at the University of Illinois on a locomotive, represented 15.6 per cent loss of fuel. With the price of fuel delivered on the tender taken at $1.93 per ton, the total loss of fuel for the year resulting from the use of the 20-grain water would thus be $1,354. When using 7-grain water, by a similar calculation, taking 1.32 in. as the average thickness of scale and 7.82 per cent as the fuel loss, a value was obtained of $677. With respect to the cost of flue renewals a value of $234 was taken as the cost of a complete renewal and 1⅓ and 4-5, respectively, were decided upon as the number of renewals required per year under the 20-grain and 7-grain water conditions. The value of $13, which represents a 10 per cent depreciation and interest charge on a $16,000 engine and 7 cents per engine mile for maintenance, was taken as the value of the engine per day and the figures 13 and 8, respectively, were considered as the number of days lost as a result of using the 20-grain and 7-grain water.

Finally $252 and $142 were taken as the respective costs of making the running boiler repairs.

Adding these several values together for each condition as shown below, a difference is found of $977 which, when divided by 13,929, the total number of pounds of scale considered to have been removed from the water in the year in the case of the 7-grain treated water, gives the value of seven cents as the saving effected per pound of scale matter removed with respect to the above item. The above figures may be expressed in tabular form as follows:

20-Grain Water		7-Grain Water	
15.6 per cent loss of fuel due to ⅛-in. average scale	$1,354	7.82 per cent loss of fuel due to 1/32 in. average scale	$ 677
1⅓ set of flues at $234	312	4/5 set of flues at $234	187
Roundhouse flue repairs	252	Roundhouse flue repairs	142
13 days' loss of engine time at $13	169	8 days' loss of engine time at $13	104
	$2,087		$1,110

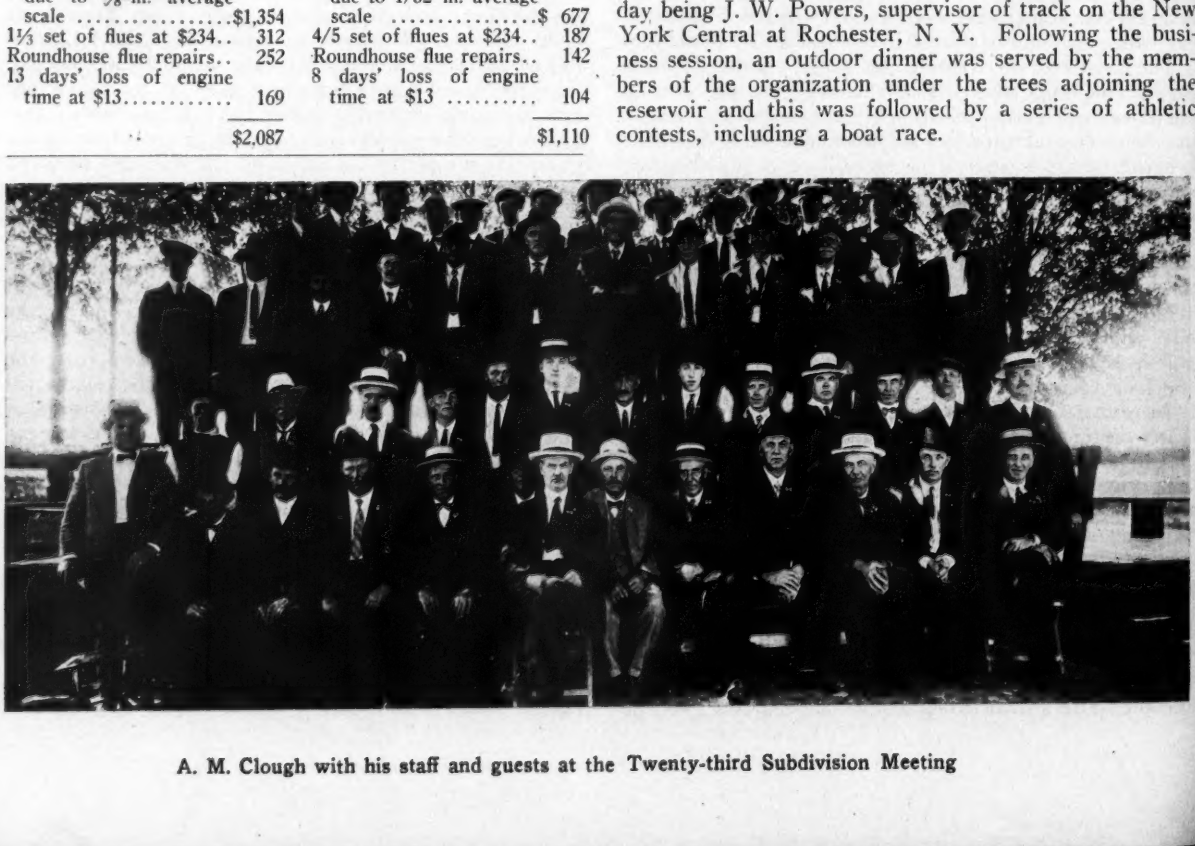
GET-TOGETHER MEETINGS OF THE SUPERVISORS' STAFF

SEMI-ANNUAL meetings of all the section foremen on his subdivision have afforded one supervisor an excellent opportunity for developing a most effective esprit de corps among the members of his staff. In addition to the development of a spirit of loyalty among the men, these meetings have engendered a feeling of friendship which has gone a long way in effecting cooperation between the foremen in the conduct of their work.

This plan has been pursued for a number of years by A. M. Clough, supervisor of track on the New York Central Lines east of Buffalo, with headquarters at Batavia, N. Y. These meetings have been held twice each year with the exception of the war year of 1918. One meeting is held in the winter at division headquarters, while the other is held in the summer in a small piece of woodland bordering on a railway water supply reservoir, situated about two miles east of Batavia. This summer meeting has come to be known as the annual meeting and field day of the men of the Twenty-third subdivision and after the completion of the business session, the remaining portion of the day is devoted to recreation and competitive sports.

At all of these meetings an effort is made to get each man in the organization to discuss some phase of his work. It also affords an opportunity for the chief clerk to instruct the men in matters of their reports to the office, while the subdivision blacksmiths and carpenters discuss the repair of tools, push cars and other equipment, with a view to correcting improper practices in handling them. Safety first, commendable acts on the part of any of those present and other matters of business or personal interest to the staff are also given attention. One important feature of the summer meeting is a formal address of welcome by some well-known man, either a railway officer or some one in public life.

The last regular meeting of this organization was held on August 13, 1921, the principal speaker of the day being J. W. Powers, supervisor of track on the New York Central at Rochester, N. Y. Following the business session, an outdoor dinner was served by the members of the organization under the trees adjoining the reservoir and this was followed by a series of athletic contests, including a boat race.

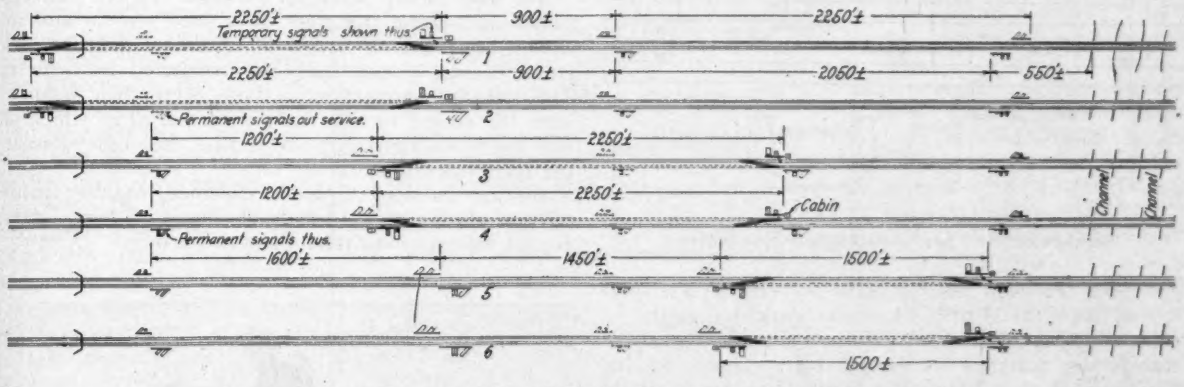


A. M. Clough with his staff and guests at the Twenty-third Subdivision Meeting

REBUILDING LONG TRESTLE UNDER TRAFFIC

The Jersey Central Develops Interesting Methods in Reconstruction Work Across Newark Bay

REBUILDING about 5,200 ft. of a 7,300-ft. double track trestle over which there is a movement of from 6 to 24 trains per hour presents an interesting and difficult problem. This is particularly true when such work cannot be carried on under traffic in the customary manner. Such was the case when it became necessary for the Central of New Jersey to rebuild a timber trestle spanning Newark Bay between the municipalities of Bayonne, N. J., and Elizabethport. Satisfactory progress was secured in this case by dividing the trestle into sections and rebuilding it by carrying on the work progressively on alternate east and west bound sections. All details as to the methods to be employed, the distribution, use and disposal of both old and new materials, the apportionment of the equipment and the forces, etc., were carefully planned and in some cases chartered in advance. In addition automatic signals and interlocking devices were installed to regulate and thus facilitate the movement of trains over the single track sections made necessary by the method adopted.



Arrangement of Tracks and Signals During Progressive Steps of Construction

The Newark Bay trestle is approximately 7,300 ft. long with a Scherzer lift span located about one mile from the west end. The longer part of the structure and the lift span carry two tracks, while the east end has three. These tracks constitute the main line of the Central of New Jersey and form practically a throat over which all of the traffic from that road's four-track main line at this point must pass in order to reach the waterfront at the Port New York. The traffic carried is very heavy, consisting chiefly of a large volume of merchandise and coal, augmented by a considerable suburban and through passenger service. Between 8 and 9 a. m. an average of 19 eastbound and 5 westbound passenger trains pass over the trestle daily except Sundays and between 5 and 6 p. m. there is a similar total movement in the reverse direction. During the time the trestle was rebuilt this was the maximum train movement per hour since, in order to prevent delays and congestion at this point, all freight schedules were changed so that such trains would pass outside of the morning and evening rush hours. Some trains, mostly freight, were also detoured over a loop line, thus relieving the congestion still further.

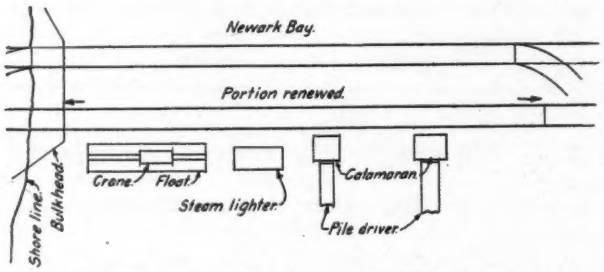
The trestle itself is a typical structure with pile bents spaced 12 ft. 6 in., capped in the customary manner and carrying the usual type of bridge decking supported on three lines of 8-in. by 16-in. by 25-ft. yellow pine stringers under each rail stringers, which were replaced by two 10-in. by 16-in. and one 8-in. by 16-in. under each rail. The Scherzer lift bridge has two spans of 125-ft. clear openings and is carried on concrete foundations surrounded by timber racks and fenders. The caps, stringers and a large part of the bridge ties had so deteriorated as to necessitate practically complete rebuilding in order to prolong the life of the structure for a period sufficient to allow the legal and other difficulties now standing in the way of a new structure to be settled satisfactorily. Eventually the trestle will be replaced by a four-track, high level, steel and concrete bridge of modern design and construction.

As delivery of yellow pine at the time that reconstruction was decided upon, was uncertain, Douglas fir was purchased and transported by boat from the Pacific Coast. It is interesting to note that some of the timbers were in place in the bridge in less than 60 days from the time they were cut from the trees in the northwest. On the arrival of the material it was transferred to a yard where it was classified and piled ready for delivery to the site of the bridge when needed. The equipment assembled for use in rebuilding the trestle consisted of work trains, locomotive cranes, a car float, a ferry, two floating pile drivers, three catamarans, a track piledriver, a lighter, tug and miscellaneous tools, etc.

In order to reduce the interference with operation to a minimum the trestle was divided into eight sections, consisting of four sections each of eastbound and westbound tracks west of the draw. The sections adjoining the draw were comparatively short and in order that the work on the remainder would not be delayed by work at draw, they were reconstructed completely before the main work was started. All of the stringers and ties and some of the caps of the trestle were replaced for a distance of approximately 700 ft. This reconstruction was carried out on Sunday when the traffic is comparatively light and one track could be abandoned. The entire work was planned carefully in advance and diagrams furnished those in charge, showing the location of all switch points, reinforcing timbers for the turnouts, and signals, etc. All rebuilding was carried forward a definite distance in each move, starting and ending at

a predetermined point. No crossovers were used, the track being cut and swung over as each section was alternately given over. After the completion of the work immediately adjoining the draw a pile driver was run in on the land end of the eastbound track and the track at each end of this section cut, swung over and connected with the turnouts installed in the westbound track simultaneous with the connecting up of an automatic block and interlocking system for the single track line so formed. Since the piles, with a few exceptions, were good, the work of replacing them proceeded rapidly and it was thus possible to follow shortly with gangs of men, taking up the rails and inner guard rails. These rails were swung over between the tracks of the westbound main where they remained until the rebuilding of the trestle was completed. As soon as the piledriver had finished its work the track at the end of the section was swung back, the piledriver removed and the track cut back.

While this work was getting under way the car float carrying a locomotive crane operating upon a track laid centrally for the full 240 ft. of its length, was run along side the shore end of the three-track part of the trestle. Loaded cars were then run out on the third track and



Arrangement of the Construction Equipment

sufficient new caps and stringers for one section were loaded onto the float. This was done by means of cable slings and locomotive cranes, the method used for transferring material on the job being similar to that described on page 109 of the March, 1921, issue of the *Railway Maintenance Engineer* for handling cross-ties. After receiving its load the car float was moved to the site of the section being rebuilt and made fast at the starting end. The lighter and two derricks, each with a catamaran, were likewise moved up and made fast.

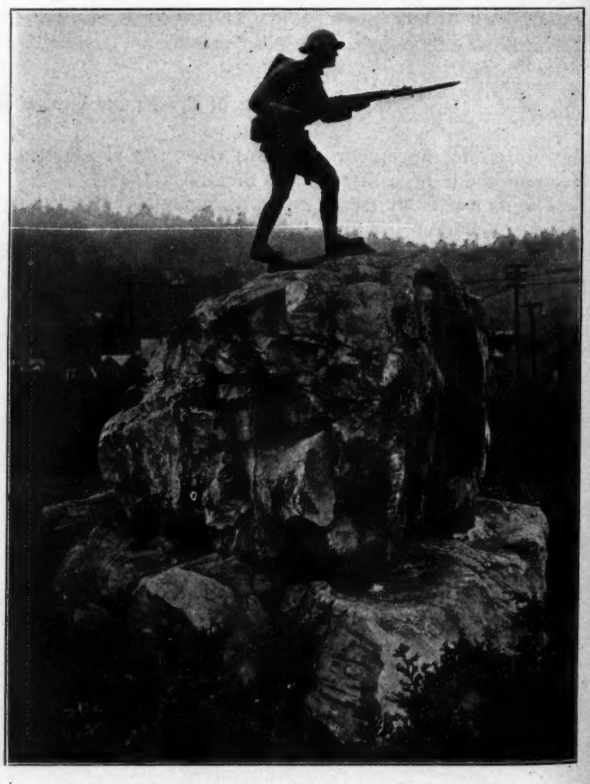
As fast as the old rail, etc., was swung clear, the bolts on the old stringers and wooden guard rails were cut off with acetylene torches. The locomotive crane then began to tear out the old timbers, sorting out the good ties, which were held on the float until used on the westbound track.

When sufficient rail had been swung over to allow the floating piledrivers to work they began to tear out, sort and load the timbers. The piledrivers actually performed the greatest part of the work of removing the old material, for as soon as the locomotive crane had cleared a small length of the trestle it was diverted to the distributing of the new caps and stringers. Since the crane could move the full length of the car float, it could remove old timber and distribute new material over a length of trestle somewhat greater than 240 ft. before it became necessary to move the float. This was a considerable advantage, since it assured practically an unbroken continuity of the work and in addition provided an exceedingly flexible unit. Whenever a change was necessary either for the car float or the piledrivers, they were moved under their own power.

With the caps and stringers in place the next step or stage was the installing of the bridge ties. As they were surfaced on one side, framing was necessary. Since the car float would no longer be adjacent to a stretch of trestle by the time it was ready to lay ties, they were handled independently by work trains. At favorable hours a work train would bring out two cars of ties with a locomotive crane between. The ties were then distributed by means of slings, the average time necessary to unload two cars being about 15 minutes. With the installation of the ties completed, the rail was swung back to line, gaged and spiked. Once the work was well under way practically every stage of the program was going on at the same time at various points along the trestle. After all the old timber had been removed, the catamarans and the lighter were towed to the shore end of the three-track section and the timber was unloaded and transported away while the equipment was prepared for the next section's work. All the good ties which were loaded on the lighter were held for the work on the westbound track. All new ties were used under the eastbound track since that track carries the heaviest traffic. When the locomotive crane had completed the distribution of the material it likewise was moved up to the same location and there received its next load of new material and supplies. Only enough material to finish one section was carried at a time.

The finishing-up work on the first section consisted simply of cutting the track back into service and installing turnouts in order that the westbound track could be cut, swung over and connected up with it. The same reconstruction methods were then followed until the second section was completed, after which all equipment was moved up one section, each time alternating from track to track.

We are indebted to R. V. Reamer, engineer maintenance of way of the Central Railroad of New Jersey, for the information contained in this article.



In Commemoration of Railway Men in the War

IT IS IN all probability true that a day does not pass in which several situations do not arise in connection with the every-day work of every maintenance man, whatever his position, which challenge him to answer correctly some inquiry, give him occasion to search in his own mind or elsewhere for a satisfactory explanation of some incident or which await his solution of some problem. The occasion may be one in which others are relying upon him for information in regard to their problems, or his own curiosity as to the underlying principle of some machine's operation or behavior or again his conjecture on the proper way to correct some mechanical trouble, but in all cases the situation is the same in that it invites his thought. Not only this but in the same way that he judges his associates, his subordinates or superiors, by the nature of the answers they give or explanations they advance or the solutions they apply to the questions or problems of common discussion, so it is that he is being judged, unconsciously perhaps, but nevertheless actually, by his own associates, according to the nature of the answer or explanation he himself gives. Here then are two truisms which though they apply more or less to a great many fields of activity apply none the less in maintenance of way, and it is largely with reference to these truisms that the "What's the Answer?" column directs itself. If, on the one hand, by inducing thought it operates to cultivate that conditon of mind which underlies all industrial progress and converts a man's experience into something more than merely so many years of service, and, on the other hand, if by discussing questions raised by maintenance men it affords a fund of information on subjects about which all maintenance men should be informed, this column will have performed a commendable service.

Each month some problem pertaining to the work of each of four branches of mainteance of way is presented in the form of a question to be discussed or answered in the issue two months in advance. The answers are solicited from the readers. The following are answers to questions appearing in the August issue, except that the answer to be given for Question No. 1 was not received in time for presentation in this issue.

What Would Be Your Answer?

The following questions will be answered in the December issue:

(1) What precautions should be taken to keep a chisel from breaking in cold weather?

(2) How can you brace falsework bents driven in deep water in a case where the caps are so close to water level that plank cross bracing can not be applied above the water?

(3) Is anything to be gained by painting or coating stucco?

(4) How should valve boxes be protected in cold weather?

THE HOT WATER WILL DO NO HARM

On a small concrete job the supply of water was obtained from a locomotive tender through the injector and the question was raised as to the wisdom of using this water before it had cooled off. Would it be injurious to use the water while hot?

This question raises no controversy among those who are well versed in concrete practice, but as it is a problem that actually came up in the course of railroad work, it deserves an answer. It also affords an opportunity to comment on methods of heating materials for concrete in winter.

Concrete materials will not be injured by heating them to the temperature of boiling water or even the temperatures of steam obtained at the ordinary boiler pressures. In fact, the best method of heating concrete materials in winter time is to blow live steam into them, for the simple reason that this is sure to keep the temperature within safe limits and also avoids drying out the stone as occurs when they are dry heated. The real danger in heating materials comes when they are heated over a fire as this may result in temperatures that will cause calcining. But even if this does not take place, the heating results in drying out the stones to such an extent that they will absorb an undue amount of the water used in mixing.

THE PROPER SIZE OF PUMP SUCTIONS

Should the intake pipe of a pump be larger than the discharge pipe, and if so, how much and why?

Generally speaking, the intake pipe should be larger than the discharge pipe, for the reason that less frictional resistance is presented to the passage of water through the pipe. This in effect is the statement made by the engineer of a large pump manufacturer and is borne out by the practice of pump manufacturers in making the pipe connection on the intake side of pumps usually larger than that on the discharge side. It is conceivable, however, that cases arise where this general rule does not apply and for this reason it is hardly possible to answer the question without some discussion of the prin-

ciples and practical considerations which underlie the determination of the size for a layout.

The primary requisite of an intake pipe, of course, is that it will supply the required amount of water per minute or hour, whatever the unit of time may be. Whether or not it will do this depends chiefly upon the head of water tending to force the water through the line and the amount of frictional resistance encountered. Frictional resistance is an exceedingly variable factor, depending upon the length of pipe, the velocity of flow, the condition of the interior surface of the pipe and the number, kind and arrangement of valves, bends, etc., in the line. It may range from a negligible quantity to a value large enough to seriously interfere with the operation of the entire pumping system. As an example of the effect of frictian, an instance may be cited where, in a clean cast iron pipe 10,000 ft. long and 1 ft. in diameter, 99½ ft. of the 100 ft. of head available was consumed in overcoming the friction in the line. As a further example of how friction varies with the velocity, in a 6-in. pipe delivering 350 gal. of water per minute, and where the velocity will accordingly be about 4 ft. per second, the loss of head per 100 ft. of smooth pipe alone will be equivalent to about 1½ ft. of head, where in a 4-in. pipe delivering the same amount of water, and where the velocity will accordingly range around 8 ft. per second, the loss of head will approximate 10 ft. for each 100 ft. of straight, smooth pipe.

Most pump intakes are under suction rather than head so that any loss of head by friction has a very large bearing not only on the amount of water which can be obtained, but upon the efficiency of the pump's operation, the tendency of air to leak through joints and the pump valves, etc., increasing very rapidly with the amount of suction required to lift the water into the pump. Accordingly when it is understood that ordinarily pumps are capable of discharging the water into a line under a greater pressure than that at which it enters the pump, it is readily perceivable that whenever the intake pipe is under suction, at least, it should ordinarily be larger than the discharge pipe. When the intake pipe is under a head as occurs in some instances on railroads, the friction factor is not so important and cases may frequently arise where no larger pipe need be used on the intake side than the discharge side, particularly where the head on the intake is considerable and the duty of the pump comparatively small. Where a question arises as to the proper size of the discharge pipe, however, it can only be decided after considering all the local conditions which might have any influence upon the flow of water through the line even to the extent of considering the condition of the pump and the degree to which it is loaded and the possibility of the water when entering the pump of causing foaming or hammer due to its velocity.

A FURTHER ANSWER TO A JULY QUESTION

The practice on this road has been to lay the roofing parallel with the eaves so that the seams are horizontal. It has never been laid so that the seams are up and down the slope or vertical.

One of our men thinks that the vertical method will give a smoother roof, but if the joints are not thoroughly cemented or the cement does not hold the wind is more liable to get under the rows of the paper and tear it loose. The horizontal method also gives a better lapping of the joints as the highest layers are lapped over the lower and the roof will be drier because the water will not leak through the seams if they should not happen to be cemented properly.

In replacing old shingles with composition roofing the old roof boards often have to be taken up and relaid with close joints and it is easier to do this with the horizontal method than with the vertical. It is also more easy to take care of a roof in replacing the shingles or other old roofing as a small amount of the roofing can be turned up and taken care of more readily in case of storm.

JOB TUTHILL, Assistant Chief Engineer, Pere Marquette.

VENTILATING OF FLOORS

Why is it necessary to ventilate the air space under a floor where there is no basement?

The space under floors must be ventilated so as to make sure that the air in the enclosed space will be sufficiently dry to discourage rot. Timber decay in all cases is the result of fungous growth which, even in the case of the so-called dry rot, requires the presence of some degree of moisture. In view of the fact that fungous growth is encouraged by the absence of sunlight, as is the case in the space underneath floors, it is especially necessary to avoid dampness.

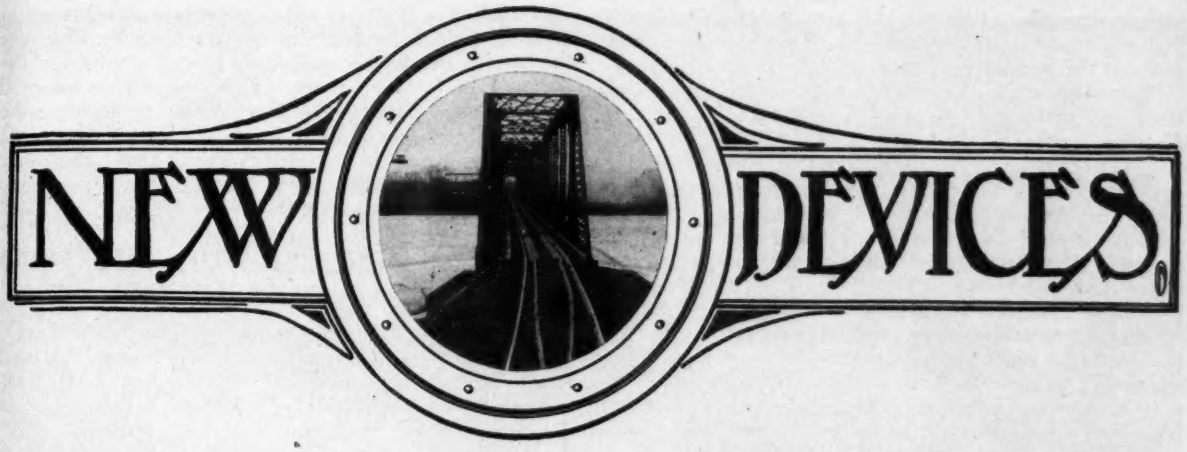
WHAT ONE EMPLOYEE CAN DO

THE opportunity which comes to an employee in railway service to conserve the interests of the road for which he works is indicated by the following statement of the record of R. Harrington, bridge tender and pumper on the Southern Pacific, Texas and Louisiana lines. This record, which was published in the *Southern Pacific Bulletin* for September, also indicates the appreciation of this efficient service on the part of the officers of this road.

"R. Harrington was employed on March 15, 1889, as assistant bridgetender and pumper at Mermentau. After serving for two years he was made pumper and bridgetender, and has served in that capacity ever since. He has won the premium for the best water station on the Louisiana lines every year an annual inspection has been held. The steam pump in the water station had been in operation 18 years before Mr. Harrington went there and is still in perfect working condition. In the 30 years that Mr. Harrington has been pumper at Mermentau, he can recall but two occasions when pump repairer had to be called to make repairs, and in both cases it was necessary, because pumper did not have the proper tools. On three or four occasions pump repairers have been to Mermentau to make repairs to large pipes account pumper not having pipe tools of that size. Mr. Harrington makes all his own repairs to the pump and small pipes. He bought his own pipe tools. He states the making of minor repairs keeps tank from going dry and saves the company the expense of sending men and material to Mermentau and he sees no reason why all pumpers cannot make these small repairs.

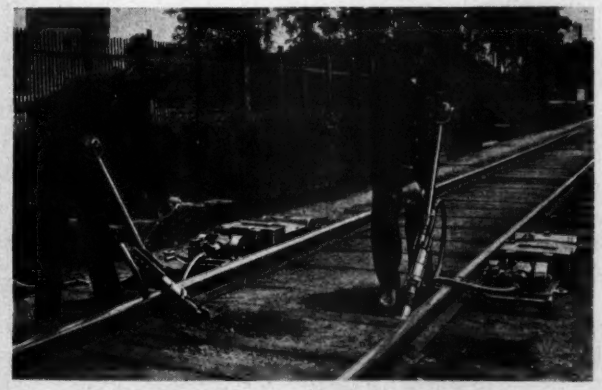
"About fourteen years ago the company furnished each water station with a toolboard fully equipped with small tools. Mr. Harrington is using the same tools that were originally furnished with the exception of one small pair of plyers, which were stolen and which he replaced by purchasing a new pair with his own funds. The bridge lanterns now in use on the drawbridge are the same that were in use when Mr. Harrington first took charge 32 years ago. They are always clean and shining and do not look as though they had been in use three months. When the founts leak, instead of ordering new ones he solders the old ones.

"The Mermentau water station is always in first-class condition and ready for inspection any day in the year. During the 30 years he has been pumper, there has never been a time when a train could not get water on account of the condition of the pump."



A NEW PNEUMATIC TIE-TAMPER

AMONG the labor saving devices which have recently been introduced on the state-owned and other railways of Sweden, Denmark and Norway is a lightweight pneumatic tie-tamper of unique design manufactured by the Artiebolaget Hassleholms Werkstader, Hassleholms, Sweden. This equipment consists of two units, one the power plant and the other the tamping unit. The power unit is quite small and includes a single-cylinder, two-cycle, water-cooled gasoline engine direct-connected through a two-throw crankshaft to the connecting rod and piston of an air cylinder or pulsator, the water and gas tanks and tool case all being mounted on an angle iron frame. The assembly is very flat in order to secure the necessary clearance when it is placed outside the rails and on the ends of the ties as shown. The frame has handles at all four corners as well as rollers which bear against the rail and prevent the unit from binding as it is moved along. The total weight is about 220 lb.



The Tampers in Use in Sweden

The tamping tool is connected to the power unit by an air hose varying in length from 9 ft. to 15 ft. and a light but strong chain. The power unit is pulled along by this chain. The tamping tool is also simple, being fundamentally only an air cylinder and plunger or piston. The tool itself is connected to the piston and piston rod through a recoil spring. There are no valves controlling the air either at the power unit or at the tool, the tamping action being secured by the pulsation of the air contained within the system as connected up. Thus the tamper strikes a blow on every stroke of the engine, or at the rate of 1,200 blows a minute. An interesting feature of this tool is that even though the engine is kept running continuously, the tool itself does not work unless the point is pressed against something, and as soon as the pressure it released the motion ceases. Where traffic conditions permit, one or more units are often mounted on a light push car which is pushed or pulled along the track. The device is also used for surfacing and drilling rock or stone and for chipping metals.

A NEW STEEL FOR TRACK SHOVELS

NOW THAT we are in the midst of the after-the-war period of readjustment every effort is being made to apply wartime methods and developments to the implements of peace. For instance, one would hardly expect that the war would have an influence on anything so commonplace as a shovel, but this is what has happened. Molybdenum steel that was developed of war necessity and used in parts of the Liberty motor and for the armour plates of "baby tanks" is now being applied to the manufacture of shovels.

The properties of steel containing small amounts of molybdenum have been recognized for many years, but it was not until the scarcity of certain other elements used in the alloys during the war period that the value of this rare metal was developed by intensive research. Briefly, the presence of molybdenum in steel makes it possible to obtain a very high degree of hardness, strength and resistance to wear, while retaining a toughness that insures against breakage. These qualities which were of great benefit for certain war purposes are obviously of advantage in shovels. Consequently, certain facts concerning this material and the properties of the steel alloys containing it, together with an account of the developments made in its manufacture into shovels are of interest and value to the users of this tool.

The following is a summary of the range of physical properties:

	Pounds per square inch
Tensile strength	201,000 to 270,000
Elastic limit	180,000 to 225,000
Elongation in 2 in.	7% to 15%
Reduction of area	17% to 45%

Molybdenum is essentially an American product. It is estimated that 80 per cent of the world's supply is in the state of Colorado. In the mineral form this element is always combined with oxygen or sulphur, but when reduced to the metallic form it is a white metal resembling platinum. It may be combined with steel in various proportions, but its principal advantage lies in its use in quantities not exceeding one per cent. Like certain other elements used in alloy steel it renders the steel

high in strength and elastic limit and also affords a much higher ductibility or toughness as compared with other steels of the same strength.

Molybdenum also has the advantage of cheapness as compared with other elements producing approximately the same results.

A further advantage is the fact that steel containing molybdenum may be welded readily, something which can not be done with nickel steel for instance. From the manufacturers' standpoint, considerable advantage is found in the fact that molybdenum steel is readily produced with great uniformity in quality. This advantage is derived from the fact that a variation of 500 deg. in the quenching temperature produces very little effect on the strength, elastic limit, hardness or ductility. Consequently the manufacturer is allowed considerable latitude in carrying out the manufacturing processes without influencing the quality of the product.

In developing the applicability of molybdenum steel to the manufacture of shovels, the Wood Shovel & Tool Company of Piqua, Ohio, carried out an elaborate set of interesting tests to determine the serviceability of shovels made of this material. The endeavor was to develop a machine to serve as a substitute for the actual manual handling of the shovel and at the same time produce conditions sufficiently uniform to afford thoroughly fair comparisons. The equipment in question provides for the mounting of four shovels on a revolving shaft in the manner of a paddle wheel so that the blade of each shovel is driven in turn through a bed of crushed granite; the positions of the shovels relative to the material, the speed and the length of the stroke are arranged to conform as nearly as possible to the conditions of actual shoveling. Shovels mounted on this machine are driven through the broken granite for a long period of time or until one or more of the shovels develop defects.

Tests made with this equipment showed that the molybdenum shovels withstood the hard service for a much greater number of passes than shovels made of other materials, or expressed in other words, the molybdenum shovels showed far less wear or breakage than any other shovel for the same number of passes. The manufacturers place particular emphasis on the fact that there was a great reduction in the wear on the edge of the shovel and on the two faces, as well as in the instances of breakage or cracking, tearing of welded joints, or other defects.

It has also been shown that the shovels will withstand extreme distortion without permanent effect; thus in the photographs a molder's shovel was given a full quarter bend backward and forward, after which it returned to its normal shape without any apparent injury. Besides the greater life which the manufacturer claims for the molybdenum shovel because of the quality of material used, they have also found it legitimate to decrease the thickness of the metal used because of its high strength. As a consequence the shovels are lighter than most other makes of shovels of the same class, a matter of no small advantage to the workman.

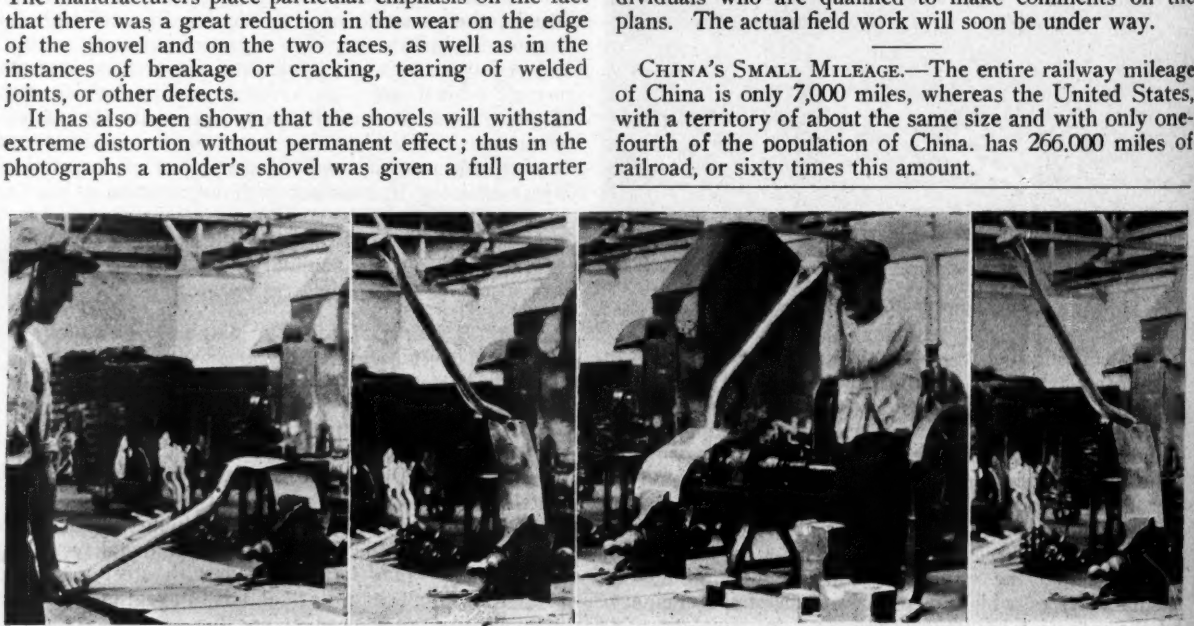
A PLAN TO REDUCE THE TIME AND COST OF AIR SEASONING WOOD

AN EXTENSIVE field study on the air seasoning of wood is being organized by the Forest Products Laboratory of the University of Wisconsin at Madison in co-operation with the saw mills and wood utilization plants throughout the country for the purpose of determining that practice in the piling of lumber which will result in the fastest drying rate consistent with the least depreciation of stock, the least amount of required yard space and the least cost of handling. The study will be carried on concurrently on both hard woods and soft woods and all the important commercial woods of the country will eventually be included in the study.

Heretofore no systematic attempt has ever been made to work out the exact conditions under which drying time and drying costs can be reduced to a minimum and it is not actually known which of the many methods of piling in use at the present time will give the quickest and most economical results under given climatic conditions. The studies, therefore, are expected to furnish reliable and valuable information on the proper spacing of boards in layers, the height of pile foundations, directions of piling with relation to prevailing winds and yard alleyways, etc. The studies are expected also to decide whether, from a business standpoint, lumber should be dried partly at the mill and partly at the point of utilization, or whether it should be completely dried at the mill.

The tentative working plan of the study has already been prepared and copies are being sent to various organizations likely to be interested in the studies and to individuals who are qualified to make comments on the plans. The actual field work will soon be under way.

CHINA'S SMALL MILEAGE.—The entire railway mileage of China is only 7,000 miles, whereas the United States, with a territory of about the same size and with only one-fourth of the population of China. has 266,000 miles of railroad, or sixty times this amount.



Progressive Steps in an Interesting Test for Strength

The Dinner on Wednesday Evening

ROADMASTERS HOLD THIRTY-NINTH CONVENTION

Large Attendance and Excellent Reports Contribute to Successful Meeting in Chicago

THE THIRTY-NINTH annual convention of the Roadmasters' and Maintenance of Way Association, which was held at the Auditorium hotel, Chicago, on September 20-22, inclusive, was one of the most successful in point of attendance and in the finished character of the papers and reports presented in the long history of this organization. Greater efficiency in the conduct of maintenance of way operations was the underlying thought in the program. This was given expression in the form of a paper by C. A. Morse, chief engineer of the Chicago, Rock Island & Pacific, on the budget for maintenance of way work, in which he called particular attention to the necessity for a system of accounting that would enable maintenance of way officers to obtain actual cost data as a basis for the preparation of budgets and the comparison of results secured by the various forces under their direction. The same idea was expressed most emphatically by L. W. Baldwin, vice-president of the Illinois Central, who also addressed the convention. In his opinion data showing the amount of work done per dollar expended was the greatest need at the present time. That this thought was driven home is evidenced by the fact that the program for the next year's convention includes a report to be submitted on cost data on track operations.

The attendance of railway men at the convention was in excess of 500, while the banquet on Wednesday evening was attended by over 300. The report of the secretary showed an active membership list of about 1,170, which, according to book records, is approximately the same number enrolled a year ago, but actually represents a considerable growth owing to the fact that those who had become delinquent during the war period were not dropped from the roll until last year. The treasurer's report showed funds on hand to the amount of $2,150, with the current expenditures during the last year approximately equal to the income, but leaving some obligations unpaid. In view of this condition, the officers of the association felt that it was necessary to increase the income and proposed amendments to the constitution providing for an increase in the initiation fee of from $2 to $5 and the annual dues from $2 to $4 were passed in the course of the convention by a large majority.

The officers of the association who have been responsible for its activities during the past year are as follows: President, W. P. Wiltsee, principal assistant engineer, N. & W., Roanoke, Va.; first vice-president, L. M. Denney, supervisor, C. C. C. & St. L., Indianapolis, Ind.; second vice-president, J P. Corcoran, roadmaster, C. & A., Bloomington, Ill.; secretary, P. J. McAndrews, roadmaster, C. & N. W., Sterling, Ill., and treasurer, T. F. Donahoe, general supervisor, B. & O., Pittsburgh, Pa. Mr. Donahoe was appointed treasurer by the executive committee on July 9 to succeed the late Coleman King, who died on June 18, 1921.

Opening Exercises

The convention was opened by an address by P. F. McManus, general superintendent of the Elgin, Joliet & Eastern, Joliet, Ill., who outlined his ideal of what railroad men should strive for and some of the avenues leading to its attainment. He emphasized the importance of the maintenance of way department effecting economies in every possible way. In order to accomplish this it is necessary that the roadmasters and supervisors understand their work fully, as they are the closest to the problems of labor and materials. He stated that those present should seize every opportunity to participate actively in the discussion of the papers and report. "It is not enough," he said, "to attend the convention merely for the advantages to be derived by the contact with others, the papers presented and the new ideas developed in the discussion. Close attention and consideration should also be given to the exhibits of maintenance of way equipment since in that way familiarity with their possible advantages in the performance of track work

can be obtained." He said further that the increased costs of labor and materials were not ones that the roadmasters and supervisors could control, but that they could, however, control the expenditures for labor and materials so as to secure the greatest results for the money. The endeavor should be constantly to improve the output per man and per unit of material. He urged the members to work for the old spirit of loyalty and co-operation among the track men, for when that was secured it would become possible to make real and far-reaching economies.

PRESIDENT WILTSEE'S ADDRESS

This is the thirty-ninth annual convention of the Roadmasters' and Maintenance of Way Association of America, which means that it is one of the oldest associations of railroad men in existence today. Its life has covered a period within which there have been a great many changes not only in the track necessary to carry the continually increasing size of rolling stock, but in the methods of doing work which naturally accompanies such changes. This association in devoting its attention to the use of labor and material intrusted to the care of its members finds its efforts appreciated, and we should feel the same sense of responsibility in the studies of the service which is ours that is felt by the managing officers of our railroads, if we are to do our part in obtaining economical maintenance. We are now passing through a very severe and trying time of readjustment, and there is all the greater need of studying economic maintenance, especially in that of handling labor and the conservation of materials, and we should all renew our efforts to the end that the railroads may again thrive and prosper.

I think we can truthfully say that the fact of this association's existence for 39 years is proof that its objects are worthy ones and that the members in the past have kept its character on a high plane. The association now has a membership of nearly 1,200. It has grown rapidly within the last few years. Within this period the railroad executives have approved the work of this association and have helped it in a number of ways. A. M. Burt, when assistant director of operation of the United States Railroad Administration, made the following statement: "Attendance at national maintenance of way meetings should be actively encouraged and liberal allowance should be made for expenses of men attending such meetings. The men always bring back ideas and inspirations that result in more efficient work." It is a very poor man who cannot derive some good from attending meetings where questions in which he is vitally interested are discussed, not only on the convention floor, but during recesses.

Our association is judged by its publications as much as anything else, and it will be of great benefit to have the committee reports that are presented of such high class that the officers of our railroads will take an interest in them. Our discussions should be to the point, and if entered into with the right kind of spirit, will be of benefit to all concerned. I know it is very hard for busy roadmasters to devote any time to committee work, but if they will try it once they will find that it is time well spent. I quote from an article by E. H. Lee, vice-president and general manager of the Chicago & Western Indiana, on committee work:

"Summarizing, then, the advantages of committee work to the average committeeman

1—It affords education of facilities along lines not covered in the ordinary curriculum;
2—It takes the member out of a rut and enlarges his experience;
3—It affords some facilities for extending acquaintances and for enlarging the capabilities of others;
4—It promotes friendship; all of these contributing towards a comfortable and successful life."

THE OPPORTUNITIES BEFORE THE MAINTENANCE OF WAY OFFICER

BY L. W. BALDWIN

Vice-President, Illinois Central, Chicago

REGARDLESS of the wonderful improvements which have been made in the performance of maintenance and construction work, many primitive methods are still employed which must be eliminated. In my opinion we should work especially for (1) the introduction of more practical methods in our work and the establishment of some effective methods for measuring our results, that is, to determine proper units of measure of work (yardsticks); and (2) the more general application of mechanical devices to increase production along these lines. These points, boiled down, mean that we make sure that we are using the most practical, the most progressive methods we can devise and, above all, know what we are accomplishing.

It is only through the adoption of the most practical methods that we will be able to get our maintenance of way and construction work done at the proper cost. I am sure you appreciate how important it is that this work should be done economically, for the public is demanding the most efficient and economical operating methods which railway men can devise.

There is a great need for the men in charge of maintenance of way work to devise units (yardsticks) for measuring the work which the men under their supervision perform. The conditions we have to contend with on one division, one stretch of track, or even one section, vary so greatly from those on other adjacent territories, that it is difficult to apply a standard of measurement which will be workable in all sections. We all agree that the work should be done economically and within the estimates that are carefully prepared, yet we are using nothing but primitive methods in measuring the production.

It has been my experience that few men do their best unless their work, good or bad, is noticed by those who are above them in rank. There is no satisfaction in working unless one knows what he is accomplishing. Likewise, we cannot expect to get the best results from labor unless their work is carefully mapped out and systematically outlined, and unless we have a method of informing all men of the results they accomplish.

Fifteen years ago practically all of our efforts were the results of direct labor. At that time and until the war the railroads paid track labor a minimum wage. During the war the wages of railroad labor were put on a level with other lines of industry, and now in many parts of the country the railroads pay the very highest wages, which means that we should now be able to pick men for track labor who are intelligent, reliable, efficient and most suitable for their task. To do this should be one of the foremost duties of foremen, supervisors and roadmasters, of course, always being fair, in their selection, to the faithful men of long service. Output records per man, per outfit and per machine should be kept and the men apprised of the result. Output should be further stimulated through comparison, rivalry and the commendation of all good records—no man worth while is willing to be continually at the foot of any list reflecting merit. I appreciate this is not now practicable in many kinds of work, but I am sure you will agree that this subject requires much practical study to insure that all conditions and circumstances are taken into consideration and that

figures or results obtained are comparable, to the end that no man will be condemned who has done his best.

Labor-Saving Devices

When I was first connected with maintenance of way work we had few labor-saving devices. In the past few years many such devices have been put into service, yet there are still many opportunities for such equipment to produce more economical results. The high cost imposes on the supervisory officer the particular duty of obtaining the very utmost output from each such machine he may have on his territory, not only in the work for which it is especially designed, but in such other work as it may be adapted for at a less expense than the present methods. The high costs also impose on railroad managements the duty of obtaining such equipment as will produce the most economical results. Unfortunately, many of the railroad managements have not had the financial ability to purchase such equipment, although it could be shown that, after taking care of the carrying cost, maintenance and operation, the machine or appliance would result in good economies.

There are a number of labor-saving devices which may be made use of effectively. It is unnecessary to try to name all of them, but among the most important are: Ditchers of various kinds and designs; spreaders without and with ditching wings; derrick cars of various kinds and designs, from the large wrecker and pile driver to the small push car derrick for handling bridge timbers and rail-laying machines for small gangs; air compressors with various attachments for tamping ballast, drilling bond wire holes, tightening or loosening nuts, cleaning steel with sand blast for repairing, painting and whitewashing, lining tunnels with concrete and oiling joints; narrow-gage dump cars in sliding cuts to haul out material clear of the main track; ballast cars to unload in the center of track or uniformly across the track; devices for spreading ballast after unloading and for taking the surplus ballast off the top of the ties; small creeper pile drivers for fence posts of concrete and wood; mechanical and chemical means for destroying weeds; discs and mowing machines on motor cars for work adjacent to the track; motor cars; air dump cars for use with ditchers, as well as for moving dirt on a large scale; tool grinders; snow-thawing outfits, and switch point straighteners. Nearly all of these devices are susceptible of improvement.

Maintenance and construction men in a supervisory capacity need to study the equipment which they have on their territory with the view of getting the greatest possible amount of work out of it. As one example of the great variety of work which can be accomplished by one machine, take the railroad ditcher, which is probably the most versatile. In addition to the ditching for which it was designed, this machine can be utilized to load and unload rail; load and unload bridge timbers; load cinders; load and unload storage coal; load ties; take up abandoned track; transfer loads of timber, rail, etc.; load gravel from a pit, excavate a roadbed or build an embankment for new sidings and extensions; excavate for turntable pits, scale pits and building foundations; load and unload heavy scrap; load trucks and perform light wrecking service. By equipping it with leads, it can be used as a pile driver. With a bridge derrick car, self-propelled, it can be used for lifting bridge decks, thus effecting a large saving in renewing bridge ties. Therefore, the machines should be studied to see if additional work cannot be obtained from them.

Economy in Materials

Economies in both material and labor can be effected through the use of materials especially suited for use in particular places. In purchasing materials all conditions should be taken into consideration, to the end that the material in place will be the most economical and, after being placed, will prove the best in total expense over periods of time, taking into consideration the first cost, carrying expense and action on other units, such as equipment, so that the final result will be the economical one. Special methods may be used effectively in the conservation of materials, such as building up frogs and crossings of ordinarp rail, and of the rail itself, either in track or out, by the oxy-acetylene process; and of manganese by the electric welding process.

W. P. Wiltsee
President

Great changes are being made in railway methods. Old ideas are being discarded, and the railway industry is looking for the men and the ideas with which to carry on the work more effectively. I believe the railway service never was more attractive than it is today. There is a vast opportunity for men of ability, resourcefulness and the desire to be of real service. I think it is a rare privilege we have in being permitted to have a part in this age of railroading, and believe we should be wide awake to our opportunities and responsibilities.

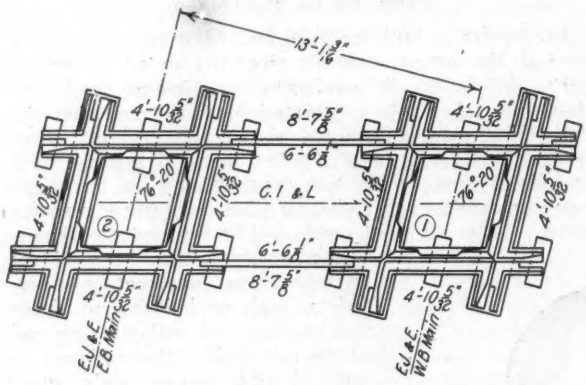
The railway situation is improving daily. I think we have every reason to be optimistic over the prospects for future improvement. During January and February the railroads of the country as a whole showed a deficit, but since then, by reducing operating expenses and with the increase of revenues which has come through a resumption of business, a small net return has been earned, and this is steadily increasing.

THE MAINTENANCE AND CONSTRUCTION OF RAILROAD CROSSINGS

YOUR committee recommends the use of manganese construction for crossings in main lines carrying heavy traffic and high speed trains. We recommend one-piece crossings for angles of approximately 90 deg., as this form of crossing does away with center joints and requires less bolts, thereby affording economy in maintenance. On double tracks we recommend that one rail only be used between joints, doing away with center joints between crossings. In yards where there are no high speed trains to contend with, two-piece crossings may be advisable because of the greater ease with which they may be installed, but as most roads have steam derricks or cranes with which to handle these heavy units, we believe that a one-piece crossing can be installed with

less expense than one of two pieces. At a diagonal intersection we recommend a four-piece crossing, as it would otherwise be too long to handle with a crane, although it is possible to insert it in that manner.

We recommend the placing of timbers under the rails of the track carrying the heaviest traffic at a square crossing instead of placing the ties diagonally, as we believe that a better opportunity is afforded to tamp the



Manganese Crossing Used in the Intersection of the E. J. & E. and C. I. & L. Tracks at Dyer, Ind.

timbers and to give them a more equal bearing than with ties. We recommend the use of ties under diagonal crossings.

We recommend the use of a plate extending the full length of the crossing under those sides carrying the heaviest traffic, in place of corner plates. Our experience has shown that in tamping under the timbers or ties under the corners of crossings where corner plates are used it is difficult to secure a solid foundation, as the plates are ordinarily too wide. The use of a plate parallel with the rail for the full length of the crossing affords one an opportunity to tamp the cross ties under the corners of the crossings which sustain the heaviest pounding.

We recommend the provision of adequate drainage under all railroad crossings. Drain tile or sewer tile should be used, according to conditions.

We recommend on all high speed main line crossings, where there is no likelihood of track changes, that a reinforced concrete slab be placed under crossing at a sufficient depth below rail to enable 8 to 18 in. of ballast to be inserted above the slab with cross ties to carry the rails. This is the only form of construction with which we are familiar which will eliminate sloppy crossings.

We recommend that rail anchors be inserted in all tracks about crossings as far back as the derail in each line. One of the greatest expenses in the maintenance of a crossing is to keep it in line for both roads. A crossing should be placed in position and then anchored to hold it there, and we believe that by anchoring each track as far back as practicable this result will be accomplished. When crossings get out of line they ride rough, moreover their life may be decreased at least as much as 20 per cent.

Committee: D. O'Hern, chairman, roadmaster, E. J. & E., Joliet, Ill.; T. Thompson, roadmaster, A. T. & S. F., Joliet, Ill.; C. T. Kimbrough, roadmaster, I. H. B., Gibson, Ind.; Jas. McDonald, roadmaster, K. & I. T., Louisville, Ky.; M. Ganley, roadmaster, A. T. & S. F., Argentine, Kan.; J. E. McNiel, inspector of tracks, A. T. & S. F., Los Angeles, Cal.; C. S. Brooks, roadmaster, T. R. R. of St. L., St. Louis, Mo.; W. R. Wiers, roadmaster, C. B. & Q., Aurora, Ill.; Charles Newberg, roadmaster, C. & N. W., Chicago, Ill.; R. Harris, supervisor, Penna., Philadelphia, Pa.; G. Stewart, supervisor, Penna., Newark, Del.; J. B. Martin, supervisor, N. Y. C., Elkhart, Ind.; C. J. Coon, engineer of terminals, N. Y. C., New York, N. Y.; Mike Griffin, supervisor, C. R. R. of N. J., Jersey City, N. J.; C. E. Genter, roadmaster, B. R. & P., Bradford, Pa.; G. G. Austin, general roadmaster, C. J., Chicago; L. C. Ayers, assistant superintendent, N. & W., Crewe, Va.

DISCUSSION

The discussion on that portion of this report in which "one piece" manganese crossing were recommended indicated that there was a decided misunderstanding as to what was meant by the term "one piece." Repeated questions put to Chairman O'Hern failed to bring out clearly whether he had in mind a crossing cast in one piece or a crossing composed of a number of pieces, assembled by bolting and arranged in such a manner that worn or broken parts could readily be replaced. However, as no motion was made to change the report in any way it was allowed to stand in the form presented by the committee.

The report was finally amended to omit the words "wrought iron," to fix the limits for the depths of ballast recommended to 8 to 18 in. and to specify the use of rail anchors as far back as practicable rather than to limit their use to any definite point established by a derail.

RESULTS OBTAINED FROM THE USE OF TREATED TIES

J. H. WATERMAN, superintendent timber preservation, Chicago, Burlington & Quincy, Galesburg, Ill., gave an informal lantern slide lecture on Tuesday afternoon, showing the marked increase in the life of ties obtained through preservative treatment. What he was most anxious to overcome, he stated, was the feeling that seemed to persist in the minds of many track men that an untreated white oak tie is far superior to any other ties to be had.

He demonstrated the fallacy of this view most emphatically by photographs as well as tables of tie records which showed distinctly that there are many species of timber which, when made into ties, properly treated and protected against rail cutting, will give a greater life than a white oak tie. Mr. Waterman's talk was based primarily on the results obtained by the Chicago, Burlington & Quincy on the test sections of track upon which records now run back over a period of about 12 years. He also touched on the proper care of ties before treatment to insure that they do not become decayed before the preservative process is undertaken. He pointed out the enormous loss entailed where the trackmen go to the expense of placing in track ties which are in such a condition that only a very short life can be obtained.

THE MOST ECONOMICAL METHOD OF HANDLING AND RENEWING CROSS AND SWITCH TIES

YOUR committee appointed to investigate this subject and report to this Association has considered it in its broadest sense, that is: (1) The estimate for tie renewals for the coming year. (2) The supply and distribution of ties during the year. (3) The application of ties in the track, both in ordinary maintenance and in new ballasting work, and (4) The disposition of old ties and finished work.

We find that records kept on a system of 9,000 miles of road for 15 years or more show an average annual renewal of 340 ties per mile of track, or an average of 10.63 per cent per year. This is an enormous item of expense and is probably the largest single item in railway maintenance. Rails are taken out when worn and transferred to light traffic lines, and when they have served their life there they are taken out and sold for scrap at approximately one-third of their original cost.

But not so with ties, for every 10 years must see an entire renewal. It therefore behooves every maintenance of way officer and member of this Association to conserve, preserve and prolong the life and usefulness of every tie in his railroad.

The Estimate for Tie Renewals

Practically every road represented in this Association has some method or system of inspection to determine the estimate for tie renewals for the coming year (some roads have very elaborate systems, while others are simple, plain estimates, all tending to the same end), and upon this inspection or estimate ties are allotted and bought and their distribution is made.

Great care should be exercised in making this estimate so that it will represent a true condition to the management. Data concerning tie renewals which have been preserved and estimates for a series of years are a valuable check, for with such data an officer can determine what part of his system is costing the most in tie renewals, and he can then investigate the causes and apply the remedy.

Sometimes apparently excessive estimates are due to a change from light traffic to heavy traffic on certain lines, and from a light ballast section to heavy ballast application, necessitating heavy renewals. Also a more progressive division officer sometimes may have a higher standard and estimate per mile than the traffic on his district will justify. With these data at hand, the officer who passes on the final estimates and allowances may determine intelligently what is needed for the next year's renewals; and upon this final estimate or allowance the purchasing agent, supply department or distribution officer arranges to purchase and furnish the ties to the various districts and divisions of his road.

The Supply and Distribution of Ties

The supply and distribution of ties for renewals on roads of 1,000 miles or less which have the tie timber on their line is an easy matter; but for a large system, where the majority of its ties must come from some other road or a distant part of its own system and go through the treating plants, be reloaded and shipped to the various divisions, a well-trained and systematic organization is required. When possible to do so, ties that are treated should be surfaced or dapped and bored for tie plates, as it saves adzing and prolongs the life of the tie.

The purchase, supply and distribution of ties must interlock one year with another, and ties must be coming to the road every season of the year. On small roads which have their own ties, which are not treated, it is preferable to leave the ties in the original piles at the source of supply when purchased until early in the spring and then load and distribute them directly to the divisions according to the previous estimates and allotments, so that the work of tie renewals may be started as soon as the season will permit. These ties should be distributed from cars to the various sections as needed.

On larger systems of 2,000 to 8,000 miles of road whose supply is far away this practice cannot be done, for ties must be moving through the treating plants continually and be handled when the car supply and motive power can be utilized to the best advantage. Oftentimes in the spring and summer when the needs are greatest one cannot get the cars or engines. He must therefore run his ties through the treating plants and get them out on the remote divisions early in the winter and spring, when labor, cars and power can best be spared for this work.

The loading of ties at the source of supply can be handled more economically by contract than with section or extra gangs, as one experienced tie loader working by contract will load more than two average section men and at much less cost. It is also a heavy burden on the remote division or territory to take its maintenance forces to load ties for other districts.

On roads where the necessity does not require it ties should not be scattered along the track during the winter for next summer's renewals, but they should be unloaded and piled in small piles of 25 or more at convenient points for distribution by push car in the spring, or as needed. Later in the spring and in the summer when actual renewals have begun, ties should be scattered from cars as nearly as possible where needed to save handling by push cars.

Application of Ties

The roadmaster and foreman on any section or division should and does know what his allowance and necessities are on any given territory, and should have his ties distributed as nearly in accordance therewith as possible. Here is where economical methods of application come in. On old ballasted or dirt track all ties needed for the year should be applied at one time going over and the track be resurfaced and dressed, as necessities require. The practice of making three or four applications of ties per year over a territory is expensive and is not conducive to good and economical track maintenance.

Where heavy ballasting or reballasting is to be done ties can be renewed more economically at the time of ballasting, especially where heavy rock, slag or cement ballast is being placed than prior to the ballast work. On many lines, on account of weather, soil or labor conditions, it is necessary to rush tie renewals to the exclusion of other work during certain periods, while in the southern half of the territory represented in our Association ties may be renewed at almost any season of the year. However, even in that territory it is preferable to renew ties between the months of March and November, devoting the time during the winter months to other equally important work.

The use of tie tongs prolongs the life of ties. The insertion of picks in the top sides or surfaces of ties should be strictly prohibited, as this practice hastens decay and reduces the life of ties.

What has been said above of cross ties is equally applicable to switch ties, except in heavy yards. At outlying points switch ties should be inspected the same as cross ties and only such as have served their life removed. Whenever 60 per cent or more of the ties in any given switch are to be removed it is good maintenance to remove the entire set and use the good ties taken out in other nearby back tracks when needed. In yards or heavy terminals, interlockers or crossovers where traffic is heavy, a track should not be disturbed until necessities require, and then renewals should be complete and permanent. Any good ties removed can be used elsewhere with light cost for handling. A comparative statement of the number of ties removed per man per day and per month on section and roadmasters' districts stimulates renewals and lessens the cost per tie. However, unless watched and checked closely, ties are often removed from track which have a year or more life in them.

The Piling and Disposition of Old Ties

This is no small item of expense in tie renewals and is a legitimate charge to this account, and must be so considered. The increased cost of labor both in the maintenance of way and transportation department makes it prohibitive to load and haul old ties into terminals for engine wood, as was done in years gone by,

and one must get rid of them the cheapest and quickest way. In terminals they must be hauled out and burned or given away for quick disposition.

On roads in the west, where fuel is scarce, farmers and patrons of the road will gladly haul them away and use them and in many instances render some valuable service for them, such as plowing fire guards, giving right of way for snow fences, etc. This practice should be encouraged, as it saves time and money, and lessens the cost of tie renewals and encourages a kindly feeling between the railroad and its patrons. However, unless these old ties are removed in a short time they should be piled and burned and the right of way and grounds kept clean.

The handling and renewal of cross and switch ties covers the period from the original inspection and estimate until the final work is done, the old ties removed and the track and grounds dressed up. It requires constant supervision and attention to save time and timber.

Committee: E. P. Hawkins, chairman, division engineer, M. P., Osawatomie, Kan.; C. O. Congdon, district engineer, M. P., Kansas City, Mo.; George W. Koontz, roadmaster, D. & H., Carbondale, Pa.; R. J. Vaughn, roadmaster, Utah Railroad, Hiawatha, Utah; W. L. Anglin, roadmaster, N. & W., Petersburg, Va.; John Barth, supervisor, C. C. C. & St. L., Mattoon, Ill.; S. R. Cupples, roadmaster, S. P., Truckee, Cal.; J. P. Costello, roadmaster, A. T. & S. F., Pueblo, Colo.; Walter Johns, supervisor, Penna., Trafford, Pa.; R. Swenk, supervisor, Penna., Norristown, Pa.; J. O'Leary, roadmaster, G. N., Minneapolis, Minn.; M. S. Miller, supervisor, P. & R., Philadelphia, Pa.

DISCUSSION

The section of the report dealing with making of estimates for tie renewals brought forth discussion as to the advisability and value in making the estimates in the fall. It was stated that as a general rule a road uses approximately the same number of ties each year and that possible economies in tie renewals can only be effected at the time of renewal. In this respect it was thought that fall estimates were somewhat too vague and general and that spring estimates were better. It was brought out that the main advantage to be found in fall estimates was that it made it possible for the purchasing to be done and the ties received and distributed to the most advantage. It was stated that where the track was raised more ties were needed for renewal than if such work had not been done. Under such circumstances it was suggested that all foremen, or whoever made the preliminary estimates, be advised what track and how much of it would be raised during the coming year so that proper allowance could be made.

The statement of the committee that wherever 60 per cent of the switch ties in heavy yard leads were to be removed, the entire set should be removed, drew a wide variety of opinions. At first the criticisms were particularly directed at the question of whether there ever were any switches where that many ties required renewal, it being stated that such a condition meant an unsafe track and was a reflection on the roadmaster. It was then explained that this section referred to switches over which there was a heavy traffic and which could contain ties of which a percentage as high as 60 would be approaching a condition justifying renewal. Under such circumstances it was thought advisable and economical by many that the switch ties should then be renewed out of face and the old ties used at other less severe locations. It was emphasized that switches of the type concerned must be kept in a better condition than ordinary or outlying yard switches and that, therefore, the practice was justifiable.

The discussion also brought out that wherever operating and other complications made it difficult it was real economy to renew out of face, thus reducing further work at the switch to a minimum for some time. Once the practice of spotting is started, it will nearly always have to be continued. A vote on the relative merits or renewing switch ties out of face or by spotting in showed opinion to be fairly evenly divided, with the majority slightly in favor of the former.

METHODS OF STIMULATING FRIENDLY RIVALRY AMONG TRACK FORCES

YOUR committee appointed to investigate and report to this Association on the above subject submits the following report:

It is first necessary to determine just what we understand "rivalry" to mean. Literally, it is "The state or the contests of rivals, to strive to excel." The committee does not believe that it was the intent of the Association, in selecting this subject, to take this literal application, but rather to consider a competitive test between track forces, not only among the different gangs, but also among the different foremen and men employed in each of the particular gangs, or on the respective sections.

The subject has probably been given little thought or attention by supervisory officers, and there are no doubt many railroads that are not giving it the attention it deserves. Information submitted to the committee reveals the fact that some roads have no definite systems of inspections, and no definite plan of the work for the year, so that it would be impossible to create a "friendly rivalry" which would tend to increase the efficiency of the forces.

Rivalry is created among track forces by the application of one or more of the following methods, practices or systems:

(1) THE PREMIUM SYSTEM

The premium system is a subject of such magnitude that endless discussion and explanation could result. Therefore the committee has confined itself to the describing of several methods, both proposed and in practice, and recommends that they be given consideration as far as practical, according to the local characteristics of each road.

One method that is in common use on several railroads requires an inspection in the spring and in the fall. In the spring the roadmaster or other maintenance officers go over the division with the purpose of making a program of the season's work and at the same time taking notes of the conditions on each section. In the fall inspection the sections are marked on a basis of 100 per cent, subdivided substantially as follows:

Alinement, surface and gage	25 per cent
Spiking ties, lining and spacing switches	25 per cent
Drainage and ballast	20 per cent
Material, grass, weeds, right of way	10 per cent
Neatness about section houses and stations	10 per cent
Sidings	5 per cent
Fences and road crossings	5 per cent

The fall inspection is made by an instrument which records all track irregularities, and each section foreman is provided with a copy of each section record, in order to give him an idea of the progress that the other foremen have made in the season's work. Cash prizes, medals, sign posts, and also division prizes, are awarded to the best sections, and also to the division showing the most efficient work done during the year, based, of course, on the allowance, materials used and man hours worked, in comparison with the progress made. Cash prizes range from $50 for the section to $100 for the supervisor on the division. On some roads it is the practice to erect a sign post on the section with the letters, "PRIZE SEC-

TION," and at each limit of the division a sign post with the letters, "PREMIUM DIVISION."

In connection with the premium system the committee recommends that a foreman who receives this prize for two consecutive years be offered an inducement to keep his section in advance of the others by allowing him a higher rate of pay as long as he is able to keep his section in this advanced condition.

The following practice is in effect on several railroads and is conducive to higher efficiency and to the stimulation of friendly rivalry among the track forces: (1) At the beginning of each year go over each foreman's section with him and plan the work for that year. (2) After the information for the entire division has been obtained and a program decided upon by the division engineer, roadmaster and foreman, the proposed season's work is tabulated and each foreman is given a chart showing the program as it applies to all sections on the division or subdivision. Follow this each month with a percentage chart, by sections, showing the percentage of work done, in ties, line, surface, etc., and an analysis of the figures showing who is making the best record with the allotted number of men, so that each foreman is familiar with what the other foremen are doing.

L. M. Denney
First Vice-President

J. P. Corcoran
Second Vice-President

P. J. McAndrews
Secretary

T. F. Donahoe
Treasurer

MEETINGS

One of the best ways to develop rivalry among the foremen and also among the men is to assemble a number of them at either division meetings or at a general meeting for the discussion of their common problems in track work. These meetings not only broaden the views and interest of the men, but they go farther, for when the men get together they exchange their different ideas, all of which tends to create enthusiasm and a desire to excel in their particular line or activity. Meetings of this nature should be confined to the discussion of track, roadbed and right of way in general. If possible, the higher officials should attend, one or more of whom should give a well-considered talk or paper on a seasonable subject and lead the others in discussions. The program should not be allowed to become too technical, while the subjects should be selected and discussed in plain matter-of-fact English, so as to get the men to thinking and to promote a closer relationship and acquaintanceship with and among the men.

Under the present conditions no factor will be as helpful in developing men into loyal employees of a railroad, for the greatest problem now is the maintenance of a good relationship between employee and employer, between the men and their supervisory officers. The effect will reach through the foreman to the rank and file of the men.

PERSONAL CONTACT WITH THE MEN

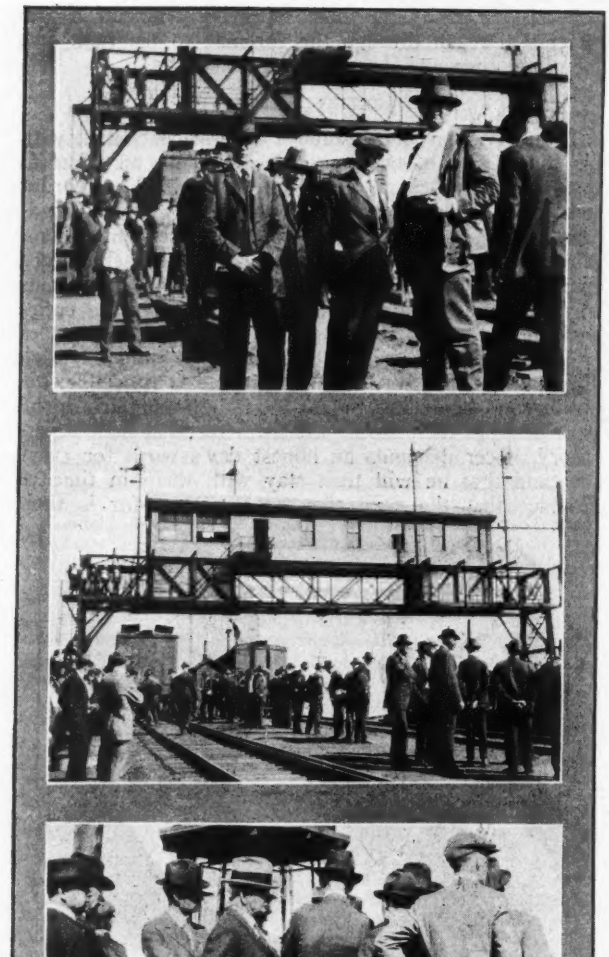
A supervisor should establish a personal contact with his foremen as often as possible and make an effort to instill a live interest among them in their work. In order to obtain the desired results it is necessary for the roadmaster to inspect the work in progress frequently, compare his work with that of the foreman on each side of him and give him the benefit of the comparison, and thus instill friendly rivalry that will extend over the entire division.

The ideal condition and the greatest stimulus to track forces is to make their living quarters comfortable, desirable and homelike, and to treat the men fairly in all your dealings with them. Let them feel that their supervisory officer demands an honest day's work for every day and that he will then stay with them in time of trouble; that the road they are working for is their road, that they are a part of it, and that it is the best railroad in the country.

Committee: George Koontz, chairman, roadmaster, D. & H., Carbondale, Pa.; L. S. Weaver, inspector, Erie, Susquehanna, Pa.; M. J. Nugent, roadmaster, D. & H., Albany, N. Y.; C. H. Gruver, roadmaster, C. R. I. & P., Manly, Ia.; J. H. Logan, roadmaster, C. R. I. & P., Pratt, Kan.; J. S. McGuigan, roadmaster, St. L.-S. F., St. Louis, Mo.; F. J. Meyer, assistant engineer, N. Y. O. & W., Middletown, N. Y.; R. J. Vaughn, roadmaster, Utah Railroad, Hiawatha, Utah; W. Shea, general roadmaster, C. M. & St. P., Chicago, Ill.; E. P. Hawkins, division engineer, M. P., Osawatomie, Kan.; H. T. Reinicker, assistant superintendent, N. & W., Portsmouth, Ohio; R. W. Bowler, supervisor, Penna., Washington, D. C.; J. McCoy, supervisor, Penna., Jersey City, N. J.; J. W. Powers, supervisor, N. Y. C., Rochester, N. Y.; G. O. Broussard, supervisor, S. P., Morgan City, La.; R. E. Keough, assistant engineer M. of W., C. P. R., Montreal, Que.

DISCUSSION

The discussion concerning the methods adopted by different roads to reward meritorious work disclosed the fact that, while many roads have directed considerable attention to this subject, much difference exists in the methods employed. On the New York Central, according to J. W. Powers, the method consists of making one inspection a year; this inspection is limited to a determination of the surface, line and gage and the condition of roadbed and is carried on to ascertain what foremen deserved reward for their work rather than to determine the condition of the road.



Roadmasters Visit Clearing Yard

The C. & E. I. was well represented
Under the signal tower at the hump
General Superintendent Schreeve explains the operation
The secretary was also present

On the Pennsylvania, J. L. Gressit stated that the system was not uniform, and that on the division over which he had partial jurisdiction the matter of fixing awards was left to the supervisor on the theory that his knowledge of conditions throughout the year constituted a better basis for making awards than the result of one or two inspection trips.

Referring to the method described in the report, J. L. Gallavan stated that on the Union Pacific this method gave every evidence of being a satisfactory one and that it stimulates rivalry. On the Norfolk & Western, R. H. Smith stated the method followed is to make a fall inspection under a system whereby the roadmasters of the system are divided into three committees, and together make an annual inspection over the entire road, each committee limiting its inspection to one of the four classifications, line and surface, roadbed, drainage, switches and frogs and station grounds; the average of all four gradings determining which section foremen receive the four prizes given annually.

On the Grand Trunk, J. A. Regan stated that the method employed was also one of making an annual inspection, as a result of which prizes were given to the section forces and also to the two best supervisors. On the Erie, Leroy Weaver stated that the method is one of making an annual inspection each fall, at which time the condition of the track was compared with that found in the preceding year, monetary rewards then being given on the basis of the improvement noticed on the different sections. Mr. Weaver stated that, while the method at present is limited to that of determining grading upon line, surface and track, it is contemplated to extend the inspection in the future to include other subjects.

On the Rock Island System, according to H. Ferguson, a committee of four officers makes two inspections over the road annually, one in the springtime to check the condition of the road and the other in the fall to ascertain the extent of its improvement, prizes being given to the section foremen having the best sections and also to the roadmaster on each division. The Atlantic Coast Lines' system, according to S. Daniels, is one whereby the chief engineer, the three engineers of roadway and all the roadmasters make an annual trip over the road, the condition of line, surface and the policing on each of the three divisions being graded by the roadmasters of the other two divisions. The roadmaster and general roadmaster of the best division as well as the section foremen are awarded prizes.

THE BUDGET SYSTEM AS APPLIED TO TRACK WORK

By C. A. Morse
Chief Engineer, Chicago, Rock Island & Pacific, Chicago

THE question before the railroads today is how to reduce their cost of operation, and at the same time keep the property from deteriorating. The public is asking for a reduction in freight and passenger rates to correspond with the reductions in the prices of commodities and of incomes. They have all been boosted during the war period, and as they come down, there is complaint if any one in particular fails to come down with the rest.

The railroads are placed in a particularly embarrassing position, owing to the fact that, due to the action of the various regulatory bodies, their rates at the beginning of the war were below the actual cost of production for the majority of the railroads of the country. They can not, if they are to continue to operate, ever bring their rates back to that figure, even if everything else comes down to pre-war prices. The lowest that they

can reduce rates and live, must be from 25 per cent to 50 per cent above the pre-war rates.

When this is taken into consideration their present rates are not as high in proportion to what pre-war rates should have been as is the average commodity. But prices are steadily falling and there must be a reduction in railroad rates to the greatest extent that is possible and permit the railroad property to earn a fair return on the investment. Transportation enters into the cost of everything that we have to purchase; therefore, there is nothing that will do such general good to the public at large as cheap transportation.

The transportation cost on a railroad is made up principally of three items, viz.:—maintenance of way and structures, maintenance of equipment and what is classed as transportation expenses. Your association is made up of officers employed in the maintenance of way department, and you are particularly interested in the problems that affect that department, but more particularly the problems of maintenance of track and roadbed.

About 20 per cent of the cost of operation of a railroad is for the maintenance of way and structures, and about two-thirds of that 20 per cent is spent on roadbed and track. If, therefore, you can, by better maintenance methods, reduce the cost of your work 10 per cent you will be reducing the cost of transportation on your road 1⅓ per cent.

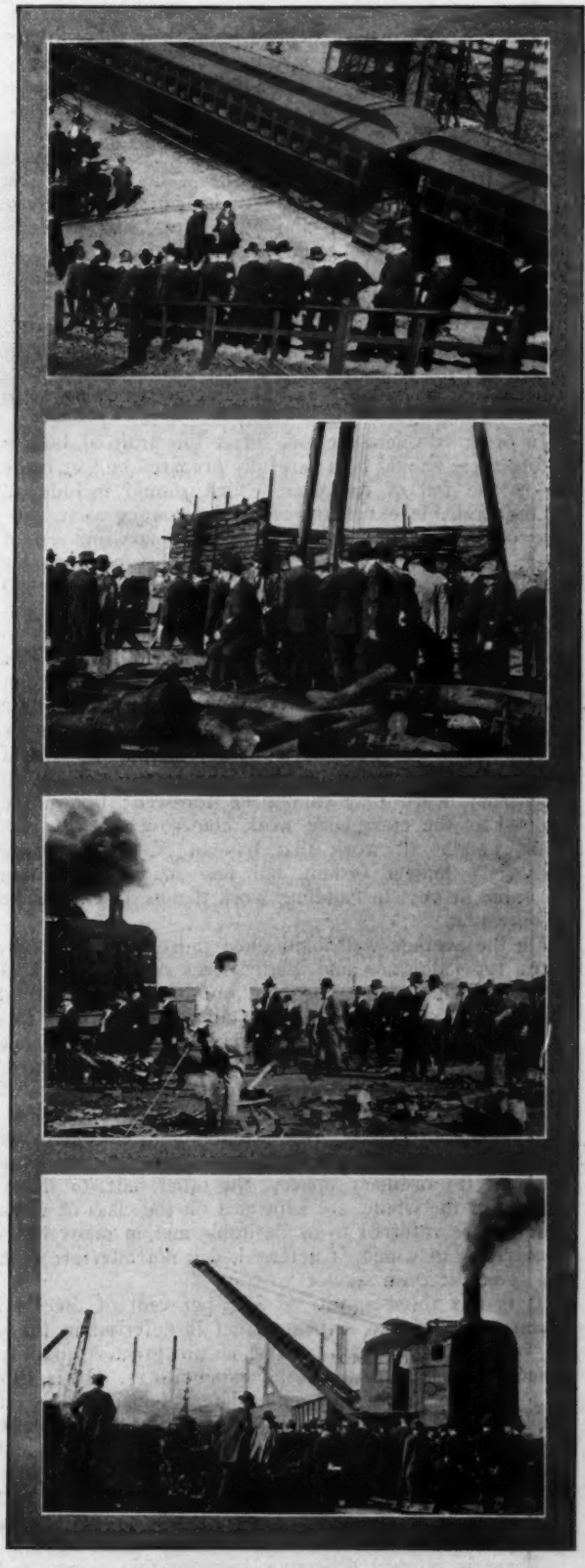
This means that on a railroad with annual operating expenses of $75,000,000 per year, $1,000,000 would be saved by the track department alone.

It certainly is worth the effort of everyone of us to do all in our power to make this saving. Let us see how we should proceed to enable us to make a saving in maintenance of way as a whole, two-thirds of which would be in the track department. Maintenance of way work is composed of a great variety of classes of work, scattered over the entire railroad. Some of it must be done to keep the railroad safe for the operation of trains, other portions of the work are done in replacing parts that are worn out, or so nearly worn out that they will not continue to serve their purpose, while still other expenditures are made to retard deterioration or to avoid large expenses in the near future on the principle that "a stitch in time saves nine."

In addition to the class of expenditures named, there are those that are made to prevent damage claims, among which are the upkeep of right of way fences. Another class is that which makes for neatness in the general appearance of the property and tends to encourage the employees to do good work and to take a pride in the property. This is generally referred to as standardization, which simply means that the work is performed in the same way on all portions of the railroad and not in a "hit or miss" manner.

In addition to these classes of work there is the work chargeable to maintenance of way in connection with additions and betterments to the property. With this great variety in the work performed by the maintenance of way forces, scattered as they are over hundreds and thousands of miles of the same railroad, on important heavy traffic main lines, and on lines of varying importance down to the little branch lines with only one mixed train each way per day, the question for the maintenance of way officer to decide is how much money he is warranted in spending on the different portions of the railroad over and above that necessary to keep the track safe for the operation of trains.

He does well on a large railroad if he gets over the whole of the line twice a year. The result is that he must depend to a great extent upon the judgment of the local officers as to the expenditures that are needed or



At the Corwith Reclamation Plant

Taking the train for Corwith
The Roadmasters were very much interested
In the scrap yard
Watching the electro-magnets

desirable on the various parts of the railroad. The local officers in turn must depend upon their subordinates to a great extent for this information.

Now, human nature is the same the world over, regardless of whether it is the roadmaster on an unimportant piece of the railroad, or a member of the Congress of the United States. Each has his eye focused on his particular territory, and he wants as large an appropriation for his territory as he can get. He can see many improvements and other work that he feels ought to be done or could be done to advantage, so he asks for two or three times the amount of money that can possibly be furnished. What is the result? As a rule the man who is the best talker, or who has the gift of making the best presentation of his case, gets more than his share of the money for work that can, if necessary, be deferred and possibly gotten along without.

In order to overcome and offset this trait of human nature there should be a carefully prepared budget made up in the fall of the year, which should include all of the probable expenditures of the coming year, outside of the amount necessary for ordinary upkeep of track and roadbed. This budget or list of desirable work (which should show the estimated cost) should be given consideration by the system head of the maintenance of way department, and a decision made as to the amount of money that could be expended for this class of work during the coming year, and that amount should be allotted to the portions of the line where such expenditures would be of the greatest advantage to the railroad as a whole, reserving an amount out of the sum total to take care of an average amount of emergency work that cannot be foreseen; this to be allotted as the emergency work comes up. Most railroads handle all work that has an A. & B. charge through a budget system, but few roads go through the same process in handling work that is all chargeable to operation.

On the average well maintained railroad the expenditures for Additions and Betterments on roadway and structure will amount to about one-fourth of the total maintenance of way expenses, and in carrying out this addition and betterment work there will be maintenance charges about equal to the addition and betterment charges; so that about one-fourth of the maintenance of way charges are in connection with addition and betterment authorities. Of the remaining three-fourths of the maintenance of way expenses about one-half are required for ordinary upkeep, the other half, or three-eighths of the whole, are expended on the class of work that I have referred to as desirable and in many cases necessary, but which, if deferred, will not interfere with the safety of train service.

It is this three-eighths or 37.5 per cent of the total maintenance of way expenses that is deferred in times of business depression and done in greater quantity when earnings permit of the expenditures. It is this 37.5 per cent which covers the deferred maintenance, if there is any on the railroad, but it is also where there is the greatest opportunity for careful supervision and good judgment to see that it is expended on the parts of the railroad where it will earn a proper return, and not where it is of no real benefit to the property as a whole.

There is no real difference between this money and that required for A. & B. work—it is only a matter of accounting. Revisions of the accounting methods have in recent years caused much that was formerly charged to maintenance of way to now be charged to Additions and Betterments. It is, therefore, just as desirable and advantageous to make up a budget for this 37.5 per cent of the maintenance of way expenditures as for the two-thirds of this amount that is charged to Additions and Betterments.

We are all loud in our praise of the decision of Congress to put a budget system into effect in connection with our national expenses, and feel that it will help to keep down expenses and reduce our taxes. The same thing applies only on a smaller scale, to the expenditures on the railroads, not only on the comparatively small amount charged to Additions and Betterments, but to the much larger part that is charged to operating expenses.

Now, with our budget made up covering all that could be foreseen the fall before, we come to the method of making the expenditures. If the budget is made in the detail that it should be, it can be either authorized as a whole or AFEs made to cover the separate items.

There will be many cases where other items will be submitted with a request that they be substituted for some item in the budget, in which cases an AFE should be required in order that the necessity or desirability of the substitution can be carefully investigated and decided by the head of the department.

To facilitate the working out of a budget for maintenance of way work the different portions of the railroad should be classified, and certain classes of work should only be permitted on the more important portions of the road—others only on certain parts. In this way the matter of considering expenditures would be simplified, as it would be known that certain standards or certain classes of work would not be permitted on unimportant branch lines. It is no uncommon thing to find local officers, for instances, widening banks to 18 or 20 ft. on branch lines that have no ballast and no prospect of requiring any, where a 16-ft. bank is all that they are warranted in maintaining. Similar cases will be found in widening cuts.

Now, with our budget system worked out and in force we come to the economies that may be secured in carrying out the work. The authority for the expenditure of money on a piece of work should carry with it the authority to order the material direct from the store department, and the authority to put on the necessary men to carry out the work in accordance with the judgment of the local officer in charge of the work. It should not be necessary to have any signature but his own on a requisition, but the requisition should show the item on the budget, or the AFE number where AFEs are issued, for which material is being ordered. The same should apply to any additional help that is required to perform the work. A sheet accompanying the pay roll should show that any new names appearing on that roll are employed on work authorized by AFE (No...), or item (No. ..) of the approved budget, it being understood that when their services are no longer needed on that work that they will be dropped or transferred to some other authorized work.

Supervision is the greatest source of economy that can be found. Give the man in charge of the work a free hand in the handling and do not curtail his supervisory force. One of the weak places in connection with the maintenance of a railroad is the habit, when business falls off and forces are reduced, of reducing the supervisory forces to the limit.

In the case of track work, if the forces are cut so low that there are only certain classes of work that one section gang can perform, and it becomes necessary to combine two or three gangs to do certain work, it is of the greatest importance that the roadmaster be on the ground all of the time, but if in the reduction his

clerk has been taken from him he must put in one or two days per week doing clerical work in the office, and the work on the road suffers for lack of his presence much more than the salary of a clerk amounts to.

If a cut must be made equal to the salary of a clerk the roadmaster should be given his option as to how he will reduce his pay roll, and in nine cases out of ten he will feel that the best results could be obtained by taking off one or two laborers somewhere on the division and leaving his clerk on the job. We find a tendency too often for the man higher up to dictate as to just what form the reduction in force shall take, while better results would be secured if the local officer was allowed to use his own judgment regarding the arrangement and classification of his organization.

It is a peculiar thing, but a fact, that practically all of the cost data that is kept in the maintenance of way department is the result of individual effort, and made up by the indivdual, because he finds that he must have some such data to enable him to estimate work. Some will secure more than others, depending on the interest they take in cost data; but the railroads themselves have, as a rule, no statistics that they require furnished or kept that will give any cost data that are of real value, either in the maintenance of way or the maintenance of equipment departments.

You will find very elaborate and detailed statistics of cost of everything in the transportation department, but the only thing that is furnished in regard to maintenance of way is the cost of maintenance of way per mile of road, and the cost per 1,000 gross ton miles; and these are of no value in comparing one division with another, as the variation in class of railroad and in density of traffic changes the results to such an extent as to nullify any apparent comparison. A division with one-fourth of its mileage branch lines cannot be compared with a division with one-half of its mileage branch lines, neither can a division with 20,000 gross tons passing over it per day be compared with a division having one-half that tonnage passing over it.

Maintenance of Way and Maintenance of Equipment make up about 45 per cent of the total operating expenses of a railroad and transportation makes up about 50 per cent. As stated above, elaborate and detailed statistics are kept and published, showing various items that go to make up this 50 per cent of the total operating expenses, and absolutely nothing of any value is kept or published as to items that go to make up 45 per cent of the operating costs on the majority of the railroads of this country. One reason for this is that the movement of freight and passengers is the real function of the railroads, and there has been a tendency to consider the providing of the track, buildings, motive power and rolling stock as a side issue.

There has been a tendency to feel that anyone could handle maintenance matters—all that was necessary was to get the work done and not delay or interfere with the movement of trains. The result has been that attention has been centered on the train movement and the costs pertaining to that and to the handling of freight, and it has not been fully realized apparently that the concentration of effort to reduce costs was only being applied to 50 per cent of the operating costs of the railroad and the other 50 per cent has been given slight attention.

From the viewpoint of the transportation officer, good track, good power and rolling stock are essential to reduced transportation expenses and good service, and are cheap at any cost. This is true, but there is no reason why the same careful study should not be given to furnishing these essentials at a minimum cost, as there has been given to conducting transportation at a minimum cost.

If we are going to do this we must have cost data statistics covering maintenance of way and maintenance of equipment; we must have these kept in a uniform way on all railroads, and we must have them published so that each road and each division on a road may know what it is costing to perform these items on the other road, or on the other divisions. Also in the case of maintenance of way they should be kept on each roadmaster's territory so that the superintendent may be able to see what each roadmaster is doing in the way of keeping down costs on his division.

Possibly one of the reasons why nothing has been done in the way of keeping maintenance of way statistics is that there must be some concerted action in defining the units, so that the data will be comparable. One of the first things necessary is to agree on a classification of the different portions of a railroad. The cost of laying rail on a track having 20 trains over it in working hours will be much in excess of the cost on a piece of road having but 10 trains over it during working hours. The cost of inserting ties will vary with the class of ballast, and between ties put in without raising the track and those put in while lifting the track out of face for a new lift of ballast. Track work in large yards should be shown separately, also track work on passing and side tracks. Classes of ballast should be made so that work on unballasted track could be compared with similar work and work on lines ballasted with similar classes of ballast could be compared.

What manufacturer is there today that does not keep statistics as to what it is costing him to manufacture the goods he is making? If he cannot produce them as cheaply as his competitor he has to go out of business, yet here we have the railroads of the country, the largest manufacturers in the world, keeping no statistics from which they can compare their costs with those of other railroads on one-half of their entire cost of operation. One reason probably why this condition has been allowed to exist is the fact that, due to national regulation, the railroads have nearly ceased to be competitive. The rates are practically fixed by regulation and the price of labor is in the same condition, and it gives an excuse, if a railroad is not making a good showing, to claim that the rates are too low or wages too high, or both, but this is no excuse for the railroads not knowing what it is costing them to furnish transportation and competing in doing those things that are similar on the different roads in an endeavor to cut their cost to the lowest point consistent with good maintenance.

With the proper statistical information published so that all can have access to it, each railroad will strive to make a good record, with the result that unit costs will be materially reduced. The Roadmasters' Association is well fitted to study this matter, and I would like to see your association appoint a committee to report next year, to classify the different types of track and recommend certain cost data forms for collecting and reporting the cost of doing certain units of work on each class of track.

My suggestion would be that but a few of the important items be listed to start with, as others can be added from time to time. Those listed should be some that all roads are doing and that the committee feels would be of value. One that I would suggest is the cost per mile for relaying rail, divided to show the cost of the different items of work that are required on a relaying job, including surfacing the new rail, unloading the new material and loading the old material. If they could get

up a form for reports on that one item and the classification of comparative portions of a railroad, they would be making a good start on the subject.

Referring to the proposed maintenance budget, which of itself means a program for the coming year's work, I want to suggest that each roadmaster work up such a program for his territory, dividing it into section foremen's territories, and have the work that he feels should be done listed after going over it carefully on the ground with each section foreman, and then furnish the section foreman with a copy of it to be put up in the tool house and that he instruct the foreman to check off each thing on the program as he gets it completed. He will have something to work to and he will come nearer accomplishing the work than he would if he did not have the list before him.

Keep the section foreman posted as to all of your plans for work on his section; it will help him out and also help you. Make him feel that he is of enough importance to be told what is to be done on his section. We are all getting more and more labor-saving machinery on our railroads and we want to keep in mind that it is purchased to save labor and money, and that with it our requirements for labor should be reduced.

A man to the mile was the force that was considered necessary in the old days. If you asked a roadmaster today how many men he needed to properly handle his work, nine out of ten would tell you he ought to have an average of a man to the mile; this even on roads using treated ties where but half the number of ties have to be inserted per year and provided with ditching machines, modern steel spreaders, center dump ballast cars, air pump ditcher cars, motor cars with mowing machine and shoulder weed cleaners, tamping machines and the various other labor saving devices. What we need to do is to take account of stock and revise our ideas of the force necessary to maintain track, where we have been furnished with machinery to do the work.

Eternal vigilance is the price of good maintenance of way—it is not lack of force, but lack of proper inspection and instructions to the men on the ground that causes bad maintenance. One of the sure signs of lack of proper supervision and of a regular program of work is to see, in riding over the railroad, two out of three section gangs just putting their hand car or a motor car on the track to go to some other place to work. If properly laid out there are few days when a section gang cannot work a full day, or at least a half a day, in one place, thus avoiding the waste of time moving from place to place four or five times per day.

It is a well-known fact that it costs to organize a piece of work and that after it is organized and work well under way that much more can be accomplished in a day or even in an hour, than could be done while getting organized. The same thing applies to this moving around to a half dozen places each day with a section gang. Each time you not only lose the time in going from place to place, but you lose the time picking up the tools and getting them to the car, and again you lose the time in taking them from the car at the next piece of work and in getting the men stretched out and working in the new place. Proper supervision and a proper program of the week's work that each section gang is to do will stop this flitting about, as the foreman will want to make as good a showing as possible on the program that was laid out for him to do that week.

It is just this lack of proper planning that tends to make track labor monotonous, and tends to make it oftentimes a time killing job. No man can take much interest in his work unless he has an objective to work to. A man who is interested in his work will do 10 per cent more work, do it easier and with less fatigue than one who is not interested. The way to interest him is to have a program which he is trying to carry out.

There is just one more thing that I want to call attention to and that is this: Too many local officials seem to think that they have performed their duty if, when their attention is called to something that needs repairing, they give instructions to the man whose particular duty it is to do that work, to attend to the matter. They have performed but one-half of their duty, when they give the instructions, the other half will not be performed until they see that their instructions are carried out. This applies particularly to the roadmaster. As he goes over the line he should give his instructions in regard to work that he wants done, in writing, keeping a copy, and then on his next trip over the road he should check up and see if it has been done, and if not, why not, and keep after it until it is done.

It would be little trouble to keep such copies by having a clip pad with a sheet of manifold paper in it, which would give him a copy of all notes that he writes and leaves with section foremen. This failure on the part of the roadmaster to follow up his instructions and see that they are followed out is the cause of many weak spots or bad riding spots in the track.

In closing I want to say that you have one of the most interesting jobs on the railroad today, inasmuch as labor saving machinery is coming into use more and more in connection with track work, and some interesting developments are soon to take place. In this connection I want to give you one word of advice: Have patience with any new device that is sent you. Your first tendency will be to say that it is no good, and to set it off the track and continue in your old methods, but remember that the machine would not have been furnished you if someone had not made a success in its use and shown that it would save money, so when you say you cannot use it to advantage you are admitting at once that you cannot do what some other man has done in the way of saving money in doing your work; in other words, that you are not as good a man as the other fellow. You cannot afford to place yourself in that position, so I say to you, have patience in learning how to operate a machine and before condemning it ask that someone be sent out to instruct you in its use, if you cannot get results from it. Machinery is going to be used more and more on your work; if you cannot or will not work it someone will take your place that can and will work it—climb into the "band-wagon" and keep up with the procession of progress.

CLASSIFICATION AND DISTRIBUTION OF SECOND HAND RAIL

IN PREPARING a report on the subject, "The Classification and Distribution of Second Hand Rail," your committee understands that it is the desire of this association to have this question developed strictly from a maintenance of way point of view and that our purpose is to formulate a classification and a method of distributing second hand rail that will facilitate the use of such rail by the maintenance of way forces. Our effort has therefore been to develop a classification of second hand rail based on various services which rail may be considered to perform and at the same time to develop a method of distribution of second hand rail that is so related to the classification that the maximum use of rail in track may be attained.

The term second hand rail includes all rail which has been used in actual service and which has been removed from track for any reason whatever.

Having outlined the basis of the plan which your committee has followed in preparing a classification and method of distribution of second hand rail, it is desirable to present some of the fundamental elements involved in this problem. In the first place, the only practical reason for having a classification of second hand rail is to have a basis for utilizing such rail in track that will tend to increase the service which we are now securing without unduly increasing the expense of items of work which are necessary to maintain track properly, and in this manner contribute to more economical track maintenance.

Increasing the service we now obtain from our rail under these conditions will result in decreased costs, both for new rail purchases and for labor and material in connection with rail renewals. The practical result of applying a classification of used rail to actual maintenance work should be: 1. To reduce to a minimum the amount of new rail purchased from year to year. 2. To secure a minimum annual expense for labor and material consumed in connection with rail renewals without unduly increasing other items of expense necessary to properly maintain track. 3. By securing minimum expense for the purchase of new rail and also minimum expense for labor and material used in connection with rail renewals, at the same time avoiding increased expense for other items of work necessary to maintain track properly, a second hand rail classification is an effective means toward securing more economical track maintenance.

The principles involved in preparing a classification and method of distribution of used rail have been outlined in the preceding paragraphs. It is also necessary to discuss briefly certain details of the utilization of rail in track which must be developed clearly in order to classify and distribute second hand rail properly.

In the first place, the source of supply of used rail should be considered. The supply of second hand rail during any year depends on the amount of new rail which the management of a railroad may decide to buy for renewal purposes. The amount of rail purchased is not necessarily determined on the basis of the quantity needed in order to secure the most economical track maintenance, but primarily depends on the amount of money available, and as long as railroad corporations must adjust their expenses to their revenues, variations in the amount of rail purchased from year to year must be expected. During periods of restricted earnings, new rail purchases will probably also be restricted, and during periods of good earnings, new rail purchases are apt to be on a rather liberal basis. This variation in the quantity of used rail which is made available from year to year is not directly related to any variation in demand for used rail, nor is the actual quantity of new rail purchased for renewals when financial conditions are favorable necessarily determined on a basis of providing a predetermined amount of used rail to meet requirements in this respect.

The demand for used rail results from rail in other than main track becoming worn beyond the economical limit, from the construction of additional branch lines, yard and siding tracks and from rail in track becoming obsolete for the service required of it. The variations in the demand for used rail from year to year have no direct relationship to any variation in supply. On account of variations in the supply of used rail depending on elements which have but little influence on the demand, it is not possible to match the supply and demand of second hand rail, and this inability to match supply and demand makes necessary a flexibility in any standard or measure that may be fixed for assigning used rail to a particular service, and it is necessary during years of restricted purchases of new rail to spread out a restricted supply of used rail over a broad demand, while during years of liberal purchases of new rail for renewals there may be more high grade used rail available than can actually be put into track during the year. The result of these changes in relationship of supply and demand is to make it necessary to assign used rail of varying quality or standard to similar services during different periods.

In addition to this variation between the supply and demand of used rail, there are also other variables which must be considered in the use of rail so as to secure economical track maintenance. The relationship between branch line requirements and main line requirements varies from time to time. The relationship between the length of main line service and the length of branch line service which will result in greatest rail return varies from time to time. There is a variation in the cost of making rail renewals on main tracks and in branch tracks which influences the manner in which rail should be utilized, the high cost of main line renewals, together with the difficulty with which the work is accomplished under certain circumstances, being almost equal in importance to the cost of the rail itself.

The variable conditions involved occur both between different railroads and also from time to time on the same railroad, and the result is to make it necessary to assign used rail to the service best suited on the basis of the current effect of all of the variables mentioned. In this connection we would point out that in order to utilize second hand rail in such a manner that maximum service is secured in track from all rail it is most important to proceed with the understanding that rail in track should be renewed when the annual maintenance cost will be less if rail is renewed than if track is maintained without making the rail renewals, having in mind that considerations of safety supersede all other considerations, and further, that the use of new rail in any track can be justified only on the basis that by its use the annual cost of track maintenance is less than would be the case if other rail were used. Therefore, in order to secure the maximum utilization of all rail in track and having in mind the principles and details involved, the following classification of second hand rail has been prepared:

Class No. 1—Main Line Relayer Rail

Class No. 1—Main line relayer rail shall include rail removed from track which, either in the condition as taken out of track or after receiving preparatory work, is suitable for use in main line running tracks. Rail for this purpose shall meet the following conditions:

First—Rail for use in tangents shall be rail which was previously used only on tangent track. If uniformly curved, rail which was previously used in curves may again be used in curves of not greater radius than the one where it was previously used.

Second—Rails shall be straight in line and surface, except that rails for use in curves may be uniformly curved to not less radius than that of the curve in which they are to be used.

Third—No driver kinked, twisted or distorted rail shall be included in this class.

Fourth—No broken or defective rail removed from track shall be included in this class.

Fifth—Rail shall not be less than 24 ft. in length.

Class No. 2—Secondary Main Track and Heavy Traffic Branch Line Track Relayer Rail

Class No. 2—Secondary main track and heavy traffic branch line track relayer rail shall include rail removed from track which, either in the condition as taken out of track or after receiving preparatory work, is suitable

for use in secondary main and heavy traffic branch line running tracks.

Rail for this purpose shall meet the following conditions:

First—Rail for use in tangents shall be rail which was previously used only in tangent track. Curved rail may again be used in curves of a radius not greater than where previously used.

Second—Rails shall be straight in line and surface, except that rails for use in curves may be uniformly curved to not less radius than that of the curve in which they are to be used.

Third—No driver kinked, twisted or distorted rail shall be included in this class.

Fourth—No broken or defective rail removed from track shall be included in this class.

Fifth—Rail shall not be less than 24 ft. in length.

CLASS NO. 3—LIGHT TRAFFIC BRANCH LINE RELAYER RAIL

Class No. 3—Light traffic branch line relayer rail shall include rail removed from track which, either in the condition as taken out of track or after receiving preparatory work, is suitable for use in running tracks of light traffic branch lines.

Rail for this purpose shall meet the following conditions:

First—Rail for use in tangents shall be rail that has been previously used in tangent track or in curves of not more than two deg. Rail which has previously been used in curves may again be used in curves of not greater radius than where originally used.

Second—Rails shall be straight in line and surface, except that rails for use in curves may be uniformly curved to not less radius than that of the curve in which they are to be used. They shall be free from driver kinks which cannot be removed without cracking or otherwise damaging the rail. They shall also be free from twists or distortions which prevent an even bedding of the rail throughout its length.

Third—No broken or defective rail removed from track shall be included in this class.

Fourth—Rail shall be not less than 24 ft. in length.

CLASS NO. 4—SIDE TRACK RAIL

Class No. 4—Side track rail shall include rail removed from track which, either in the condition as taken out of track or after receiving preparatory work, is suitable for use in side tracks over which traffic passes at slow speed.

First—Rail should be any rail which, on account of wear, driver burns, kinks, defects, spots, or other reasons cannot be made to comply with the requirements of any of the three higher classes, yet is of sufficient section and strength for use in side tracks.

Second—Rail should be not less than 15 ft. in length.

Third—Rail shall be not less than 15 ft. in length.

CLASS NO. 5—FROG AND SWITCH REPAIR RAIL

Class No. 5—Frog and switch repair rail shall include rail removed from track which, either in the condition as taken out of track or after receiving preparatory work, is suitable for use in frog and switch work.

Rail for this purpose shall meet the following conditions:

First—It shall be suitable, in all respects except as to length, for use as Class 1, 2 or 3 second hand rail.

Second—It may be of any length less than 24 ft.

Rail classed as frog and switch repair rail shall be subdivided into Class 1, Class 2 or Class 3, according to what its classification would be if it were 24 ft. or more in length.

CLASS NO. 6—SCRAP

Class No. 6—Scrap shall include all rail removed from track which, because of defects, lack of strength, length, crooks, or for any other reason, cannot be classified in any of the above classes.

RECOMMENDED METHOD OF ASSIGNING AND DISTRIBUTING RAIL

Relative to the method by which rail removed from track is to be assigned to its proper classification and also the method of distribution, it has previously been developed that on account of many variables which are encountered in the problem of securing maximum service from rail, which variables occur, not only between different railroads, but also from time to time on one railroad, a flexible standard or measure must be used in the actual assignment of used rail to various classes. The effect of these variables is such that to attempt a precise solution of the problem of their effect on rail assignment is not practicable. However, their varying effects on rail requirements must be determined in a practical manner that is sufficiently accurate to develop their effect on the manner in which rail should be utilized, and the following method of assigning used rail to the proper classification and of distribution is recommended:

First—Each railroad shall provide a rail inspection organization which shall (A) be under the supervision of such official as is responsible for the utilization of rail. This inspection bureau shall be at all times fully informed as to the condition of rail in track with a view to making it possible to carry out such a policy, with respect to rail, as may be determined upon, in order to secure maximum rail service.

(B) By means of actual inspection, check all rail in track which it is proposed to take out during any year and catalogue the various stretches of rail proposed to be removed in order of importance, together with the length of time which each stretch of rail in its present location may be expected to give satisfactory and economical performance, and from this information determine current requirements for new and second hand rail, including rail for additional tracks, which information will be an accurate statement of current rail demands, and should be submitted to the proper authority in connection with estimated requirements of the amount of new rail which should be purchased.

(C) Fix the details of the rail allotment, the quantity of new rail to be purchased having been determined, so that rail most in need of renewal shall be given preference, at the same time developing the proper standards which can be currently applied in assigning used rail to its proper class in order that the second hand rail requirements of a railroad shall be fulfilled to the greatest possible extent.

(D) Assign rail in track scheduled for removal, by means of actual inspection on the ground, to the various classes of used rail, the details of the rail allotment, together with the details of the standards to be followed in disposing of rail removed from track having been determined. At the time of the inspection there shall be indicated clearly on each rail the class of used rail to which it is assigned, together with a further notation as to whether the rail is available for immediate relaying in track or whether preparatory work is required previous to relaying in track, in which case the inspector shall indicate clearly just what preparatory work is to be done.

Second—Provision shall be made by each railroad to reclaim for use in track second hand rail which requires

such treatment and also to provide facilities for handling reclaimed rail and storing this rail, separated as to classes, subdivided as to length, with curved rails segregated, each rail to be marked plainly to show class and length, together with such additional information as may be needed, this stock of second hand rail to be used to supply the needs of the railroad for such rail.

Committee: L. E. Dale, chairman, supervisor, Penna., Philadelphia, Pa.; J. Goos, inspecting engineer, G. N., St. Paul, Minn.; P. Quinlivan, roadmaster, D. L. & W., Buffalo, N. Y.; D. C. McGregor, supervisor, B. & O., Glenwood, Pa.; J. H. McFadden, general roadmaster, M. P., Little Rock, Ark.; R. H. Smith, assistant superintendent, N. & W., Roanoke, Va.; J. E. Bone, roadmaster, M. P., St. Louis, Mo.; C. W. Baldridge, assistant engineer, A. T. & S. F., Chicago, Ill.; W. A. Brandt, roadmaster, C. & N. W., Clintonville, Wis.; William Shea, general roadmaster, C. M. & St. P., Chicago, Ill.; C. J. Coon, engineer of track, N. Y. C., New York, N. Y.; P. M. Dinan, supervisor, L. V., Geneva, N. Y.; J. H. Reagan, superintendent of track, G. T., Detroit, Mich.; M. Donahoe, general roadmaster, C. & A., Bloomington, Ill.

Discussion

One question raised in the discussion related to the time most favorable for making the inspection and classification of the rail. This was answered by C. J. Coon (N. Y. C.), who stated that the classification was best determined before the rail was taken out of the track, as the accumulation of rust which gathers quickly on rail taken out of track makes it difficult to obtain good results in the grading.

THE RECORDS AND ACCOUNTS OF A ROADMASTER'S OFFICE

IN COMPILING this report, the forms and methods of eight railroads were examined. The following table shows the reports these roads require their foremen to send to the supervisors or roadmasters. Each letter (A, B, C, D, E, F, G and H) represents a certain road, and the location of the letter in the daily, weekly, semi-monthly or monthly column shows the frequency with which the particular report is required by the road:

Labor Reports	Daily	Weekly	Semi-Monthly	Monthly
Time report and labor distribution	A-B-C D-E H	A	G	B-C
Board bills			E	A
Labor and material, joint work	A			B-C
Labor and material, extra gang	A-B			
Ballast, rail and extra gang report	B			
Ballast report	C-E			A
Siding report				F
Material reports	D			A-B
	G-H			C-D
Rail laid	C-E			B-F
Ties used	A	C-G		E
Treated ties renewed	A			
Supplies, material on hand				B
Inspections:				
Section fences and track conditions		B		
Foremen's inspection		G		
Tie plate inspection		G		
Watch comparison			A	
Work equipment on hand			E	
Signal test				B
Rail failures				B-C
Rail anchor				C
Tie plate				C
Tamper report				B-F
Crossing bell	A			
Loaded cars		A		
Work train	C			

An examination of the table shows a remarkable difference in the frequency with which the reports are required and it also shows unmistakably that when monthly time and material reports are required, daily, weekly and special reports are needed to support them or to place vital information in the roadmaster's office promptly. The reports sent regularly by the foremen to the roadmaster on these eight roads cover labor and material used and inspection reports, while the special blanks and reports give a great variety of miscellaneous information.

The principal reports, labor and material, require accurate and detailed information. The foreman must furnish a correct record of the time each man works and what he works at, together with amount of work performed, so that the pay roll can be made and distributed. He must also account for the use of material and tools.

For the purpose of reporting labor and material, your committee recommends the form at the top of the next page. This form can, of course, be modified to meet local requirements. We believe that it will place in the roadmaster's hands all the information for his pay roll, labor distribution and material accounts now furnished by any or all of the forms referred to in the preceding table. It provides an accurate check on the foremen's report. For example, if ties are being renewed, this could not be charged to ditching without being discovered. The form is so arranged that the material sheet can be detached from the time slip. It is suggested that slips of different colors be used for A. F. E. work and for maintenance work.

When the daily report reaches the roadmaster's office, the time is posted by the roadmaster's clerk and distributed by him or it is approved and sent to the accounting department, division engineer or superintendent, depending on the nature of the organization. If the time is distributed in the roadmaster's office, the form shown at the bottom of the next page will be found satisfactory.

Until such time as a perpetual inventory, worked up in conjunction with the stores department on a card system, is inaugurated, a loose leaf ledger system is recommended, an account being kept with each class and kind of material. The result is about the same as a perpetual inventory.

EXAMPLE FORM

100 Lb. Rail

Sect.	1	2	3	4	5	6	7	8	9	10	11	12
On hand Jan. 1st												

The roadmaster's office should be supplied with maps and charts, standard plans and a library sufficient to furnish any reasonable information regarding maintenance of way. For letters the committee recommends vertical steel filing cabinets.

The following reports are in general use, but are of minor importance to the roadmaster as compared with the material and labor records. They should, of course, be handled in a manner to meet the needs of the particular railroad. Where practicable we believe that blanks should be made in duplicate and one filed for the roadmaster's use, if the original leaves his office:

Accident reports.....Persons
Accident reports.....Stock
Accident reports.....Train
Applications for employment
Discharge certificate requests
Damage to track reports
Fire reports
Minors release
Notice of discharge
Order for medical aid
Pass requests
Rail failures
Shipping notices
Service certificates
Work train reports.

Form R. D. DAILY TIME CARD FOR TRACKMEN

Section.....

Date..... Time Began..... Time Quit.....

Card should be filled in and placed in mail same day work is performed. Monthly men should show time for all days not worked, giving reason under Description of Work.

Brass Number	NAME	OCCUPATION	Regular Time		Actual Overtime		DESCRIPTION OF WORK Use as many lines for each man as jobs.
			Hours	Min.	Hours	Min.	

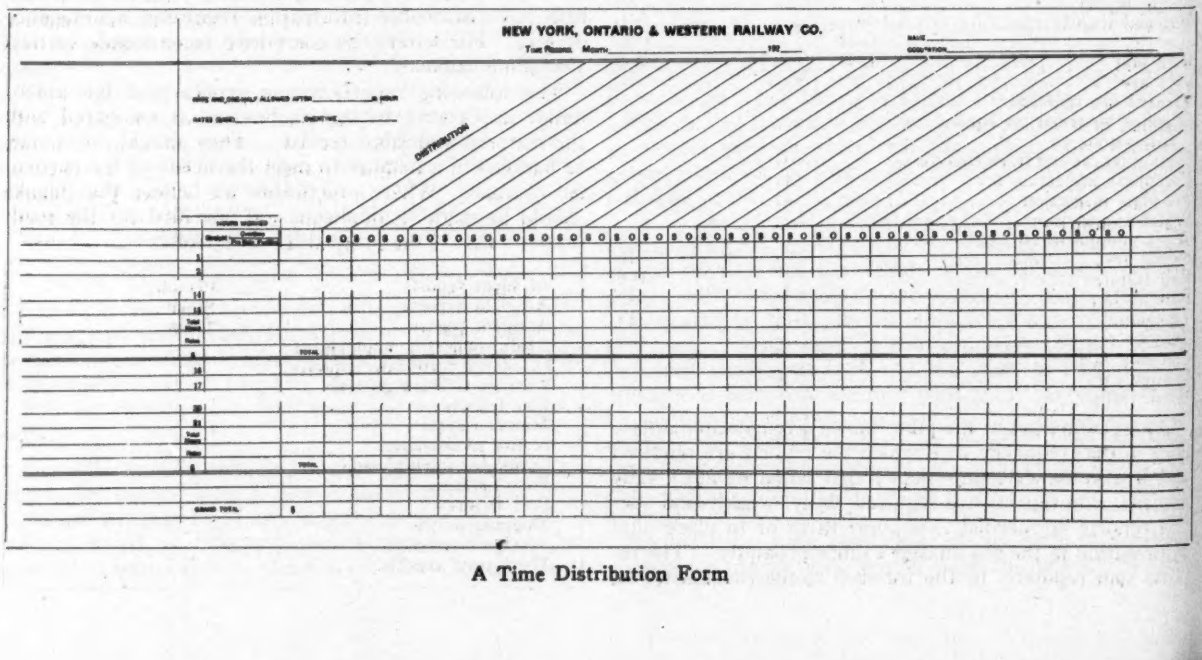
If no material is used, write none used

DAILY REPORT OF MATERIAL USED — RECEIVED — TRANSFERRED

MILE POST DESIGNATIONS						Number of Ties used	KIND OF TIES	I have today received the following material from:
South Main M. P. to M. P.		North Main M. P. to M. P.		Siding M. P. to M. P.				.....
							Yellow Pine	
							Chestnut	
							Treated Yellow Pine	
							Treated Hardwood	
							OTHER MATERIAL USED	
								I have today shipped the following material to:
								.....
							Foreman.....	

Special attention is called to the tool report and roster. The value of the form of the tool report now in general use where the foreman shows the balance on hand on the first of the month, that received during the month, that used during the month and that on hand at the last of the month, is questionable and your committee recommends that an account be opened with each tool, using the same form as for rails. The chief purpose of the tool report is to keep track of the tools given to each foreman, charged to him from the storekeeper's advice and accounted for by him on his daily report. The greatest advantage in the method here recommended lies in the easy comparison which can be made between the various gangs.

A roster of the employees, giving their names, age, addresses and service records, should be kept on cards. To assist in this a special blank should be furnished the foremen to be made out when men are hired and another



A Time Distribution Form

to be made out when any men are laid off or discharged.

No attempt has been made to prescribe detailed forms for handling the accounts sent from the roadmaster's office, such as the usual rail, angle bar, tie reports, etc., because the committee feels that the essential duty of the roadmaster's office is to assemble accurate information. The exact method of handling these accounts and records will vary according to the organizations on the various roads. Moreover, the uncertainty regarding the final method for handling Order No. 3 and the possibility of some revision of the I. C. C. accounting rules, makes it inadvisable to attempt to set up exact methods at this time.

Committee: F. J. Meyer, Chairman, assistant engineer, N. Y. O. & W., Middletown, N. Y.; W. F. Muff, roadmaster, A. T. & S. F., Newton, Kansas; T. F. Donahoe, supervisor, B. & O., Pittsburgh, Pa.; J. B. Oatman, division engineer, B. R. & P., Dubois, Pa.; W. R. Thompson, roadmaster, C. of Ga., Columbus, Ga.; A. W. Lulus, office of division engineer, Erie, Jersey City, N. J.; K. M. Hamman, supervisor, L. I., Jamaica, N. Y.; H. H. Kauffman, supervisor, Penna., Middletown, Pa.; F. Kane, accounting engineer, Penna., Philadelphia, Pa.; E. T. Howson, *Railway Maintenance Engineer*, Chicago; F. H. Hanson, general roadmaster, Great Northern, Grand Forks, N. D.; Henry Ferguson, supervisor, Grand Trunk, Toronto, Canada; J. R. Shea, traveling engineer, D. & I. R., Two Harbors, Minn.

Discussion

The discussion of this report centered largely on three points. The first related to the necessity for making the clerical work of the foreman as simple as possible. The second was that the roadmaster or supervisor be given sufficient clerical force so that the work may be completed with the minimum use of his own time. The third point on which especial emphasis was placed was the necessity for obtaining records which will serve as cost data and as records of actual output of the several gangs. The accounting as now done is of little actual value to the supervisory forces.

In discussing the work of the foremen, several cited the methods used on their own roads, laying particular stress on those forms of accounting in which the foreman completes his records entirely at the end of each day's work. One important advantage of this method is that any inconsistencies or inaccuracies caught in the supervisor's office on the following day can be referred back to the foreman while the matter is still fresh in his memory.

THE STRING LINING OF CURVES

By H. L. Pierce

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THE ART of string lining curves is so generally known that for brevity's sake no attempt will be made in this paper to explain the principles on which it is based. The different methods in use will be described from the practical standpoint instead of the theoretical. All methods require the same field work and a discussion of this should come first.

Field Work

The curve is measured off with a metallic tape in stations of equal length, usually 31 ft., because a chord of double that length, or 62 ft., has a middle ordinate of 1 in. for each degree of curvature. For curves less than one degree it is of advantage to use a longer chord in order to avoid having the variation in ordinates so large a proportion of the ordinates. A chord twice as long would give an ordinate of 4 in. for each degree of curvature. For curves of 10 deg. or over it is of advantage to use a shorter chord in order to get a smaller ordinate and a larger number of points on the curve as a guide in lining. A chord half as long would give an ordinate of ¼ in. for each degree of curve.

After the curve is measured and the stations numbered, a string is stretched tightly between each alternate station, the string being pressed firmly against the gage side of the rail about ⅝ in. down from the top of the rail, and the distance between the string and the gage side of head of rail at the intermediate station measured. This takes three men, one at each end of the string and one to do the measuring. A piece of ordinary twine 3 or 4 ft. longer than the chord to be used is satisfactory, although a fine fishing line that will not tangle is better. This process is repeated until the ordinate at each station is measured and recorded, usually in inches and tenths.

Computations are then made according to one of the methods to be described later in this paper to determine the amount the curve is to be thrown at the various stations in order to bring it to uniform curvature. The field work in giving the foreman directions as to how to line the curve depends entirely on the intelligence and reliability of the foreman. One way is to drive stakes and set tacks in them so that the tack will be 12 in. from the base of rail when the track is lined to its proper position. A second way is to use the tie as a stake and pull the spikes from the tie before lining. Using the tie thus may be necessary where the ballast is so cemented together that it moves with the track and so would move a stake. The tie being heavier and having more frictional surface will not jar out of position so easily. Another way is to set the stakes on either side of the base of rail the distance the track is to be thrown and line the base of the rail over against it.

Frequently the distance can be measured from the end of the tie to the crust left in the ballast by it in its former position. The method used will depend on the accuracy desired. As a general thing it will not be necessary to set stakes in lining low speed tracks.

There are several methods of computing the throws to be made from the ordinates obtained in the field, the description of which is next in order:

Method No. 1

Terms Used

Station—The points of equal distance marked off on the outer rail of the curve and numbered.

Chord—A straight line between two alternate stations.

Ordinate—The distance measured from the chord to the gage of rail at the intermediate station, which is, of course, at the middle of the chord.

Throws—The amounts the curve is to be lined at each station in order to obtain uniform alinement.

Throws out or plus throws—Throws of the curve away from the center of the curve.

Throws in or minus throws—Throws of the curve toward the center of the curve.

Final or Computed Ordinate—The ordinate resulting from the throws that are made.

Rules Governing

No. 1. Throwing a curve out at any station increases the ordinate at that station by the amount of the throw and decreases the ordinate of each of the two adjacent stations by one-half of the throws.

No. 2. Throwing a curve in at any station decreases the ordinate at that station by the amount of the throw and increases the ordinate of each of the two adjacent stations by one-half of the throw.

No. 3. The change in ordinate at any station is equal to the algebraic difference between the throw at the station and one-half of the algebraic sum of the throws of the stations adjacent to it.

No. 4. Given the throws at a station and the station preceding it and desiring to increase the ordinate at that station the throw at the next station may be obtained by subtracting algebraically the amount of the increase desired in the ordinate from the throw at the station, multiplying the result by two and subtracting from it algebraically the throw at the preceding station.

No. 5. Given the throws at a station and the station preceding it and desiring to decrease the ordinate at that station the throw at the next station may be obtained by adding algebraically the amount of the decrease desired in the ordinate to the throw at that station, multiplying the result by two and subtracting from it algebraically the throw at the preceding station.

TABLE 1

Station	Change in ordinate desired	Throws to produce the change in ordinate desired	Station	Change in ordinate desired	Throws to produce the change in ordinate desired
0	+0.1	0	0	—0.1	0
1	0	—0.2	1	0	+0.2
2	0	—0.4	2	0	+0.4
3	0	—0.6	3	0	+0.6
4	0	—0.8	4	0	+0.8
5	0	—1.0	5	0	+1.0
6	0	—1.2	6	0	+1.2
7	0	—1.4	7	0	+1.4
8	0	—1.6	8	0	+1.6
9	0	—1.8	9	0	+1.8
10	0	—2.0	10	0	+2.0
11	—1.2	—2.2	11	+1.2	+2.2
12	+1.1	0	12	—1.1	0
	or			or	
10	—0.1	—2.0	10	+0.1	+2.0
11	—0.1	—2.0	11	+0.1	+2.0
12	0	—1.8	12	0	+1.8
13	0	—1.6	13	0	+1.6
14	0	—1.4	14	0	+1.4
15	0	—1.2	15	0	+1.2
16	0	—1.0	16	0	+1.0
17	0	—0.8	17	0	+0.8
18	0	—0.6	18	0	+0.6
19	0	—0.4	19	0	+0.4
20	0	—0.2	20	0	+0.2
21	+0.1	0	21	—0.1	0

TABLE 2

Station	Change in ordinate desired	Throws to produce the change in ordinate desired	Station	Change in ordinate desired	Throws to produce the change in ordinate desired
0	+0.1	0	0	—0.1	0
1	+0.1	—0.2	1	—0.1	+0.2
2	+0.1	—0.6	2	—0.1	+0.6
3	+0.1	—1.2	3	—0.1	+1.2
4	+0.1	—2.0	4	—0.1	+2.0
5	+0.1	—3.0	5	—0.1	+3.0
6	+0.1	—4.2	6	—0.1	+4.2
7	+0.1	—5.6	7	—0.1	+5.6
8	+0.1	—7.2	8	—0.1	+7.2
9	+0.1	—9.0	9	—0.1	+9.0
10	+0.1	—11.0	10	—0.1	+11.0
11	—7.7	—13.2	11	+7.7	+13.2
12	+6.6	0	12	—6.6	0
	or			or	
6	—0.1	—4.2	6	+0.1	+4.2
7	—0.1	—5.2	7	+0.1	+5.2
8	—0.1	—6.0	8	+0.1	+6.0
9	—0.1	—6.6	9	+0.1	+6.6
10	—0.1	—7.0	10	+0.1	+7.0
11	—0.1	—7.2	11	+0.1	+7.2
12	—0.1	—7.2	12	+0.1	+7.2
13	—0.1	—7.0	13	+0.1	+7.0
14	—0.1	—6.6	14	+0.1	+6.6
15	—0.1	—6.0	15	+0.1	+6.0
16	—0.1	—5.2	16	+0.1	—5.2
17	—0.1	—4.2	17	+0.1	+4.2
18	+0.1	—3.0	18	—0.1	+3.0
19	+0.1	—2.0	19	—0.1	+2.0
20	+0.1	—1.2	20	—0.1	+1.2
21	+0.1	—0.6	21	—0.1	+0.6
22	+0.1	—0.2	22	—0.1	+0.2
23	+0.1	0	23	—0.1	0

Applying these five rules will solve any problem in string lining accurately and with the least amount of figuring. In this connection it is convenient to memorize the two tables above, which are constructed according to Rules 4 and 5:

To produce a change of two at each station where a change occurs instead of one, multiply each throw by two, etc. This table is of use when it is desired to change a single ordinate and make no change in a number of succeeding ordinates. Where it is desired to produce a uniform change, Table 2 will be of service.

The first part of Table 2 shows the results where the change in ordinates is all one way until the end where it is necessary to make changes that will balance. The latter part of the table shows how it is possible to start and end with a zero throw and not affect any ordinate by more than one. It should be noted that there are just as many ordinates increased by one as there are those decreased by one and that those decreased are consecutive, whereas those increased are divided equally before and after those decreased, or vice versa, as the case may be. This gives us two principles that may be stated as follows:

1. For each ordinate increased by one there must be two decreased by one each (or one decreased by two) and another increased by one in order to balance.

2. For each ordinate decreased by one there must be two increased by one each (or one increased by two) and another decreased by one in order to balance.

To illustrate exhaustively the possibilities of this method would be beyond the scope of this paper. An example from actual experience will be given to illustrate as many features as practicable.

Example

1	2	3	4	5	6	7	8	9	10	11	12
0	...	...	...	...	...	...	...	...	...	...	..
1	0.0	...	0.0	...	0.0	...	0.5	...	...	...	0.0
2	1.3	...	1.3	...	1.3	— 1.0	1.3	— 1.0	+1.0	0.0	1.8
3	3.2	...	3.4	...	3 4	— 2.0	3.4	— 2.0	+1.0	— 1.0	..
4	6.1	— 0.4	7.0	...	6.5	— 3.0	6.5	— 3.4	+1.0	— 2.4	..
5	9.0	— 2.6	10.2	+ 1.0	9.7	— 4 0	9.7	— 5.6	+1.0	— 4.6	..
6	10.5	— 7.2	11.1	+ 3.0	11.1	— 5.0	11.1	— 9.2	+1.0	— 8.2	..
7	13.0	—13.0	11.1	+ 5.0	11.1	— 6.0	11.1	—14.0	+1.0	—13.0	..
8	12.0	—15.0	11.1	+ 7.0	11.1	— 7.0	11.1	—15.0	+1.0	—14.0	..
9	12.3	—15.2	11.1	+ 9.0	11.1	— 8.0	11.1	—14.2	+1.0	—13.2	..
10	12.0	—13.0	11.1	+11.0	11.1	— 9.0	11.1	—11.0	+1.0	—10.0	..
11	10.5	— 9.0	11.1	+13.0	11.1	—10.0	11.1	— 6.0	+1.0	— 5.0	..
12	10.0	— 6.2	11.0	+15.0	11.1	—11.0	11.1	— 2.2	+1.0	— 1.2	..
13	9.8	— 5.4	11.0	+16.8	11.1	—12 0	11.1	— 0.6	+1.0	+ 0.4	..
14	12.0	— 7.0	11.0	+18.4	11.1	—13.0	11.1	— 1.6	+1.0	— 0.6	..
15	12.4	— 6 6	11.0	+19.8	11.1	—14.0	11.1	— 0.8	+1.0	+ 0.2	..
16	10.6	— 3.4	11.0	+21.0	11.1	—15.0	11.1	+ 2.6	+1.0	+ 3.6	..
17	9.5	— 1.0	11.0	+22.0	11.1	—16.0	11.0	+ 5.0	+1.0	+ 6.0	..
18	9.6	— 1.6	11.0	+22.8	11.1	—16.8	11.0	+ 4.4	+1.0	+ 5.4	..
19	12.1	— 5 0	11.0	+23.4	11.1	—17.4	11.0	+ 1.0	+1.0	+ 2.0	..
20	12.4	— 6.2	11.0	+23.8	11.1	—17.8	11.0	— 0.2	+1.0	+ 0.8	..
21	11.9	— 4.6	11.0	+24.0	11.1	—18.0	11.0	+ 1.4	+1.0	+ 2.4	..
22	10.1	— 1 2	11.0	+24.0	11.1	—18.0	11.0	+ 4.8	+1.0	+ 5.8	..
23	10.2	+ 0.4	11.0	+23.8	11.1	—17.8	11.0	+ 6.4	+1.0	+ 7.4	..
24	10.0	+ 0.4	11.0	+23.4	11.1	—17.4	11.0	+ 6.4	+1.0	+ 7.4	..
25	10.0	— 1.6	11.0	+22.8	11.1	—16.8	11.0	+ 4.4	+1.0	+ 5.4	..
26	10.6	— 5.6	11.0	+22.0	11.1	—16 0	11.0	+ 0.4	+1.0	+ 1.4	..
27	11.6	—10.4	11.0	+21.0	11.1	—15.0	11.0	— 4.4	+1.0	— 3.4	..
28	12.1	—14 0	11.0	+19.8	11.1	—13.8	11.0	— 8.0	+1.0	— 7.0	..
29	11.8	—15.4	11.0	+18.4	11.1	—12.4	11.1	— 9.4	+1.0	— 8.4	..
30	11.9	—15.2	11.0	+16.8	11.0	—11.0	11.1	— 9.4	+1.0	— 8.4	..
31	11.6	—13.2	11.1	+15.2	11.1	— 9.8	11.1	— 7.8	+1.0	— 6.8	..
32	11.9	—10 2	11.1	+13.6	11.0	— 8.6	11.1	— 5.2	+1.0	— 4.2	..
33	10.4	— 5.6	11.1	+12.2	11.0	— 7.6	11.1	— 1.0	+1.0	0.0	..
34	10.4	— 2 4	11.1	+11.0	11.0	— 6.8	11.1	+ 1.8	+1.0	+ 2.8	..
35	10.0	— 0.6	11.1	+10.0	11.0	— 6.2	11.1	+ 3.2	+1.0	+ 4.2	..
36	10.5	— 1.0	11.1	+ 9.2	11.1	— 5.8	11.1	+ 2.4	+1.0	+ 3.4	..
37	9.8	— 2.6	11.1	+ 8.4	11.1	— 5.4	11.1	+ 0.4	+1.0	+ 1.4	..
38	11.6	— 6 8	11.1	+ 7.6	11.1	— 5.0	11.1	— 4.2	+1.0	— 3.2	..
39	12.9	—10.0	11.1	+ 6.8	11.1	— 4.6	11.1	— 7.8	+1.0	— 6.8	..
40	11.3	— 9.6	11.1	+ 6.0	11.1	— 4.2	11.1	— 7.8	+1.0	— 6.8	..
41	11.3	— 8 8	11.1	+ 5.2	11.1	— 3.8	11.1	— 7.4	+1.0	— 6.4	..
42	11.2	— 7.6	11.1	+ 4.4	11.1	— 3.4	11.1	— 6.6	+1.0	— 5.6	..
43	10.1	— 6.2	11.1	+ 3.6	11.1	— 3.0	11.1	— 5.6	+1.0	— 4.6	..
44	12.4	— 6.8	11.1	+ 2.8	11.1	— 2.6	11.1	— 6.6	+1.0	— 5.6	..
45	11.6	— 4 8	11.1	+ 2.0	11.1	— 2.2	11.1	— 5.0	+1.0	— 4.0	..
46	9.5	— 1.8	10.1	+ 1.2	10.1	— 1.8	10.1	— 2.4	+1.0	— 1.4	..
47	8.3	...	9.2	+ 0.4	9.2	— 1.4	9.2	— 1.0	+1.0	0	..
48	7.4	...	7.4	— 0.4	6.8	— 1.0	6.8	— 1.4	+1.0	— 0.4	..
49	4.2	...	4.2	...	4.4	— 0.6	4 4	— 0.6	+1.0	+ 0.4	4.6
50	1.9	...	1.9	...	1.9	— 0.2	2.0	— 0.2	+0.6	+ 0.4	2.1
51	0.4	...	0.4	...	0.4	...	0 5	...	...	...	0.2
52	0.0	...	0.0	...	0.0	...	0.0	...	...	...	..
53	0.0	...	0.0	...	0.0	...	0.0	...	...	...	..
..	497.2	284.6	497.2	...	...	...	497.2	233.2	...	217.0	..

1	2	3	4	5	6	7	8	9	10	11	12
Change in ordinates		40.0					40.4				
Percentage change		8					8 01				
Lining saved by the revision							284.6—217.0=67.6 inches				

Column 1 shows the station numbers.
Column 2 shows the ordinates as measured.
Column 3 shows the first computation of throws.
Column 4 shows the computed ordinates resulting from the throws given in Column three.
Column 5 shows the revision of throws.
Column 6 shows the computed ordinates resulting from the revision of throws in Column five.
Column 7 shows the second revision of throws.
Column 8 shows the computed ordinates resulting from the second revision of throws in Column seven.
Column 9 shows the resultant throws from adding together the throws of Columns three, five and seven.
Column 10 shows a further revision of the throws.
Column 11 shows the resultant throws from adding together the throws of Columns nine and ten.
Column 12 shows the changes made in the computed ordinates by the revision of Column ten.

In practice it is rarely necessary to set down so many figures, but in this case the problem is one of the harder ones and the development is set forth in great detail for the purpose of illustration.

Illustration of Rule 3

Change of ordinate at any station, say 5 = Throw at the station or —2.6 minus ½ (algebraic sum of throws at adjacent stations vs. —0.4 + —7.2)

$$= -2.6 - -3.8 = +1.2$$

Measured ordinate at Station 5 in column 2 is 9.0 plus the change +1.2 equals 10.2 or the computed ordinate shown in column 4. Similarly change of ordinate at Station 23 =

$$+0.4 - \frac{-1.2 + 0.4}{2} = +0.8$$

10.2 + 0.8 = 11.0, as shown in column 4.

The computed ordinate at any station may be checked in this manner.

Illustration of Rule 5

Suppose throws have been computed up to Station 14 and the throw at that station is the last that was set down, what will be throw at Sta. 15 to make the computed ordinate at Station 14, 11.0?

	Amount of decrease in ordinate desired
Throw at Station 15.....	= (—7.0 + 1.0) 2 — —5.4 = —6.6
Similarly throw at Station 21..	= (—6.2 + 1.4) 2 — —5.0 = —4.6
(Rule 4) Throw at Station 23.	= (—1.2 — 0.9) 2 — —4.6 = +0.4
etc.	

Noting that the throws as computed in Column 3 are pretty heavily minus it was thought that a plus series based on the principles of Tables 1 and 2 might correct this tendency and Column 5 contains this series, which clearly over-corrects and accordingly a minus series is set down in Column 7. This looks pretty good, so the sum of the throws computed in Columns 3, 5 and 7 is taken and set down in Column 9. When this is done it is found the throws can be still further reduced by throwing the curve out uniformly one inch, the throws in Column 11 being the result. It will be difficult to improve these throws very much without spoiling the uniformity of the computed ordinates so that the problem may be considered as solved. To show the steady improvement accomplished it will be noted that the sum of the throws in Column 3 was 284.6, the sum of the throws in Column 9 was 233.2, and the sum of the throws in Column 11 is 217.0, thus showing that the additional effort saved the throwing of track a distance of 67.6 in. Thus the test of the best solution of the problem, assuming that the computed ordinates are satisfactory, is the sum of all the throws.

Method No. 2

Determine by inspection of the ordinates where the curve is flat or sharp. At the middle of each flat spot figure on throwing the track out as much as seems practicable or appropriate. At the middle of each sharp spot figure on throwing the track in as much as seems appropriate. Note the effects of the throws on the ordinates and continue the process until the ordinates are uniform or as nearly so as practicable.

At first it will be found that a good deal of throwing—on paper—is necessary; and it will not be surprising if part of the track is so thrown first out and then back again. However, such labor—on paper—is not very expensive, and practice greatly reduces it. Indeed, it is pretty well demonstrated by experience that the method is very much cheaper than that of the engineer corps and just about as satisfactory to the passenger.

The foregoing table shows what was done at the Red Bridge curve, Altoona Yard, in September, 1900. The records had this a three-centered curve. It had been staked out by the corps. The results were not satisfactory. The application of the method of ordinates produced results that were satisfactory both from the aesthetic and utilitarian standpoint. The curve is now eliminated. The table indicates some quick estimating of the proper throws, but the original notes, now lost, did not look so well.

Columns 1 and 2 show the data taken on the ground. The figures in column 3 represent the application of experience and some mental arithmetic to those in column 2. Those in column 4 are the results of the application of the principle before explained to those of column 3. For example, as it has been decided to throw the track ½ in. outward at Station 103, the increase of that amount in the ordinate at Station 103 and the simultaneous decreases in the ordinates at Stations 102 plus 50 and 103 plus 50 are noted opposite the stations. The form in which this is done has been found convenient by experience. Column 5 contains the algebraic sums of figures in columns 2 and 4. Those who are not pretty expert at mental arithmetic may prefer to make it wider and note some of the partial results in order to better keep track of the experimentation. Column 6, the net throw, represents the algebraic sums in column 3. From column 6 the stakes are set on one or the other side of the present center line, as the case may be.

Method No. 3

When assistant supervisor at Trafford, Pa., I found the following letter illustrating another method:

The stations between Stations 6 and 12, inclusive, employ one method and at the other points you will notice a second method. In the first, which is used for regular curves, one can couple 3, 7, 15 or 31 stations. He then adds the first plus twice the second plus the third, and sets the sum out as 476, then proceeds in the same way with the next bracket, including the last in the first bracket. Then add the sum of the three brackets in the same way until you reduce them to one sum as 1,571. You then divide the sum by 4. Understand your center, which in this case would be station 9, is never thrown and you will find same marked OK in the last column; 1,571 dividede by 4 gives you 393. You then make the necessary throws for 476 and 365 to make them both 393. At station 7 then you throw in 83 and 365 you throw out 28. You then divide by 4 the 393 and arrive at an average for your ordinate on your curve, which is 98. You then find the throws of the remaining stations by the same methods, taking into consideration your previous throws, such as at station 8. You have an original ordinate of 104. Station 9 is nothing for throw and station 7 is 83. So you use the old Snyder method in this way: 104 + (½ of

1	2	3		4			5	6
	Original middle ordinates to 100-ft.	Proposed throws		Effect of throws on ordinates			Final ordinates	Net throws
Station	Centers	+Out	—In					
102	0 ″	.....	....	.....	.....	.....	0 ″	0
+50	½″	.....	....	—¼	.....	.....	¼″	0
103	1¾″	+½	....	.....	+½	.....	2¼″	+½
+50	4 ″	.....	....	—½ —¼	.....	—¼	3 ″	0
104	4¼″	+1 +½	....	—⅜	+1 +½	.....	4⅛″	+1½
+50	5¼″	+1¾	....	—⅞ +⅝	+1¾	—½ —¼	6¾″	+1¾
105	8 ″	+¼	—1¼	+1¼	+¼ —1¼	—⅞	7⅛″	—1
+50	8¾″	.....	—2½	+1¼	—2½	—⅛ +⅜	8 ″	—2½
106	8¼″	.....	—2½	+1	—2½	+1¼	8 ″	—2½
+50	8½″	.....	—2	+½	—2	+1¼	8 ″	—2
107	8¼″	.....	—1	—⅜	—1	+1	7⅝″	—1
+50	4¾″	+1¼	....	.....	+1¼	+½	6½″	+1¼
108	6 ″	.....	....	—¼	.....	—⅜	5⅛″	0
+50	4½″	+½	....	—¼	+½	.....	4¾″	+½
109	4½″	+½	....	.....	+½	—¼	4¾″	+½
+50	5 ″	.....	....	+⅛	.....	—¼	4⅞″	0
110	5¼″	.....	—¼	—⅛	—¼	.....	4⅞″	—¼
+50	4½″	+¼	....	.....	+¼	+⅛	4⅞″	+¼
111	5 ″	.....	....	—⅛	.....	—⅛	4¾″	0
+50	4½″	+¼	....	.....	+¼	.....	4¾″	+¼
112	5¼″	.....	....	—⅛	.....	—⅛	4¾″	0
+50	2½″	+¾	....	—¼	+¾	.....	3 ″	+¾
113	¾″	+½	....	.....	+½	—⅜	⅞″	+½
+50	½″	.....	....	.....	.....	—¼	¼″	0
114	0 ″	.....	....	.....	.....	.....	0 ″	0

83) = 145 (you throw away the half) 145 — 98 = 47, or your throw for station 8. After you have all the throws for your stations do not forget that you will change the ordinate of one station on each side of your working

Station	Measured ordinate		Computations			Computed ordinate		Throws	
1	1¼	10		10		10	1¼	....	.....
2	4⅛	33		33		33	4⅛	....	.....
3	8½	68		68	60 57	57	7⅛	....	.....
4	8⅜	67		67 +16	83 +6 89	89	11⅛	+22	+2¾
5	10⅛	81		109	101 98	98	12¼	....	.....
6	14¼	114		98		98	12¼	—57	—7⅛
7	16⅛	129	476	4)1571		98	12¼	—83	—10⅜
8	13	104		4)393		98	12¼	—47	—5⅞
9	11¼	90	365 1571	98		98	12¼	OK	OK
10	10⅛	81				98	12¼	+31	+3⅞
11	10⅞	87	365			98	12¼	+28	+3½
12	13¾	110		97		98	12¼	+2	+2/8
13	12	96	95	97		97	12⅛	+2	+2/8
14	12⅛	97		96	97	97	12⅛	....	.....
15	10¾	86	94		97 +2 96	96	12	—2	—2/8
16	12	96 +6	88	96 +3	93 92	92	11⅜	—24	—3
17	13⅜	107	99 −6	91	88 89	89	11	—38	—4¾
18	5½	44	52	44	47	47	5⅞	—16	—2
19	1⅛	9		17		17	2⅛	.....	.....
20	⅛	1				1	⅛	....	.....
21	0	0				0	0	....	.....

basis as stations 5 and 13. Although there is no throw for these stations you change the ordinates in station 5, you add 28 to 81, making 109, and in station 13 you subtract one from 96, making 95.

In the other method you can use it on any curve and only the stations included in the brackets are thrown. When the bracket covers only one station, thus

3	68	57
4	67 +22	89
5	109	98

you will notice that station 4 is thrown out for the full amount, 22, while the station on either side is corrected for half this amount, or 11.

When more than 2 are within the bracket, thus:

6	20	22
7	24	22
8	22 +2	22
9	24	22
10	20	22

only the first inside and the first outside are affected, each for one-half of the throw. You then add all of your throws, etc.

This method is interesting but cumbersome and not very practical.

OTHER METHODS

W. F. Rench, a former supervisor on the Pennsylvania Railroad, has written a book entitled "Trackwork Simplified," in which there are a few chapters on string lining curves, but nothing superior to what has already been described. His theory of varying the ordinates at each end of a curve to obtain a cubic parabola is in error, for the reason that a cubic parabola is a curve of uniformly varying radii and since middle ordinates vary indirectly as the radii the variation in the ordinates at each end of a curve should be unform also and not such a series as he describes. This portion of his book appeared also in the Railway Age Gazette for May 15, 1914. Another article appearing in this magazine for July 16, 1915, was entitled "Graphical Method of String Lining Curves," by H. M. Church.

CONCLUSIONS

1. Method No. 1 is the best method to use.
2. The lining of curves by the string line method is much superior to that of the transit in the following respects:
   (a) Saves labor and therefore expense.
   (b) Saves time.
   (c) Is more readily adaptable to the various problems that arise, such as compound curves, avoiding obstacles, putting easements on the ends of simple curves, etc.
3. By reversing the method of field work it is possible to lay out new sidings to advantage. In fact, the transit can be relegated to property surveys and running tangents, as it is not necessary to run the alignment of curves on any track, either in existence or proposed.
4. A conscientious use of the string line method will produce better riding track, reduce derailments, decrease the uneven wear of rail and reduce the labor required to produce these results by any other method.

In other words, if you want less worry, less labor, greater accomplishment and most satisfaction with results obtained, "string line your curves."

DISCUSSION

Several members raised the question as to the feasibility of carrying out the string lining method with the usual type of man employed as section foreman, but J. M. Fair (Penna.) explained that as this work was ordinarily carried out the measurements of the curve were made by the supervisor or his assistant, who, with the notes in hand, made the necessary calculation of the throws on the basis of which relining stakes were driven. The foreman was then given instructions to throw the track so that one of the rails was a fixed distance from each stake. W. M. Camp (Railway Review) contended that as the measuring of linear distances with a tape was a very important detail of the lining of curves with a transit, the accuracy of the transit method was largely dependent upon the accuracy with which the tape work was done. For this reason, he felt that the string lining method compared very favorably with the regular survey method as to accuracy. C. J. Coon (N. Y. C.) questioned the value of the string lining method for the relining of long curves and did not favor dependence on it in other cases than for local checking.

L. F. LOREE SPEAKS AT ANNUAL DINNER

THE annual dinner of the Roadmasters' and the Track Supply associations was held at the Auditorium hotel on Wednesday evening and L. F. Loree, president of the Delaware & Hudson Co., was the speaker of the evening. Mr. Loree spoke in part as follows:

I think it may be taken as a general proposition that the foundation of good railroading is good track and that the foundation of good track is good drainage. It is in this latter respect that our practice falls far short of European standards. In other respects, our maintenance practice is fully as good and in many respects much better.

If you find recurring trouble through bad surface in a particular section of track, you are likely to find it due to defective drainage. If the surface is allowed to get out of hand and to become wavy, rolling the cars as they pass over it with a motion much exaggerated at the running board 12 to 14 ft. above the rail, to the discomfort and sometimes to the danger of the brakeman, not to speak of the effect on the structure of the car body itself, particularly its roof, you may be sure it will make itself felt in the tractive effort of the engine.

What the transportation officer has a right to look for is track in proper surface, alinement, gage and curve compensation, resting upon a minimum of ten inches of ballast that will readily dispose of storm water and melting snow, upon a roadbed properly drained, free from soft spots, of sufficient width to support the track, and with suitable runways ahead of the switch points to enable their safe and convenient handling. No effort should

be spared to see that these requisites receive adequate attention.

But, however interesting it might be to take up these matters and, in detail, the means of handling them, they are not the most important things that press for attention at the moment. What we have to do is to rescue these properties, from which close to ten millions of people get their living, from the deplorable state of demoralization in both the personnel and the upkeep to which they were reduced by the administration of the directors general.

There are three ways to improve the character of the personnel: (1) Employ a better class of men; (2) educate those kept; and (3) discharge the inefficient and incompetent.

The greatest difficulty in securing competent help, and in honest, capable workers securing positions of trust, exists in the very limited number who may be known intimately by anyone employing others in positions of responsibility. Many are in need of faithful and efficient help. Many deserving workers need employment. The ordinary employment agency but illy stops a portion of the gap. We all ought to address ourselves to the building up of better means of handling this important question. If the employee is carefully selected and, on physical examination, is found to be free from the defects of bad heart, weak lungs, hernia, color blindness and other prohibited defects, and is reasonably intelligent (because we have sufficient cause for anxiety without being bothered with stupidity), no effort should be spared to explain to him both the reasons and the methods governing the work in which he is engaged and to bring him as rapidly as possible into a position not only to perform the work, but to do it with a full appreciation of the results to be attained and the underlying reasons therefor.

Control of the men can only be maintained by supervision and by discipline. Such is the constitution of man that there is always a small but turbulent minority against whom we hold our properties, our lives and our religion itself at the price of the jail, the penitentiary and the gallows. Like bad order cars, bad order men should be kept down to about 4 per cent of the total. If they were allowed to run up to 12 per cent or 14 per cent they would ruin us. Railroad employment is to a marked degree regarded as a protected service. Once a man's name gets on the pay roll, he is hedged about by constant and numerous artificial restraints as a permanent fixture. In gardening it is not sufficient that the soil be good and well sustained by fertilizers and the seed the best. The resulting crop depends largely upon cultivation and weeding and, similarly, in the railroad business carefully selected men, education and training will not suffice. To them must be added systematic and unwearied weeding. You must know your men and those that, from whatever cause, are palpable misfits you should eliminate at once.

When you have brought the track to its proper condition and the men to the old relation of loyalty to the company and fidelity to the work with which they are entrusted, you will doubtless remain disturbed by the problems confronting us involving the economic conditions of the immediate future. I am sorry to say that I do not come to you with any message of optimism. On the contrary, I believe we are faced with conditions of such a trying character that they can only be surmounted, let alone shortened, by strenuous effort and self-denying frugality. What are the conditions that make for prosperity and what is there to be said about them?

We have something like 5,735,000 men out of work in the United States, 1,500,000 out of work in Great Britain, and huge numbers unemployed in other countries. Largely the machinery of production has ceased to function. Warehouse goods cannot be sold to those with empty stomachs because the latter at the moment have nothing to give in exchange which the holder of the goods desires. When goods on hand cannot be sold, further production will not be undertaken.

It is the common knowledge of everyone that the efficiency of the workman fell off from one-third to one-half during the period of the war, and while some recovery has been made, it is partial only and much still remains to be done.

We look about us in vain to see evidences of that courageous spirit of undertaking that we formerly knew. Partly it is due to the fact that the cost of material and labor is so high that everyone doubts whether the earnings of the future can be made to support the cost of construction undertaken now. Even to a greater extent it is blanketed by a system of taxation that offers no insurance against losses, but, through excess profits taxes, income taxes and inheritance taxes, absorbs all the gains. No one would expect an intelligent and resourceful body of men, to whom alone we can look for exhibitions of enterprise, to deliberately walk into a trap set to catch them coming and going and set so that notice of its working is given to all.

Employment of the men annually added to the ranks of labor is conditioned upon additional capital investment, and the failure not only to maintain but to increase our savings for investment, while embarrassing to all, will work its greatest hardship upon labor. These capital investments are very large. For every man on the railroad payrolls there is a capital investment of $10,000. Where are you under present conditions to look for the savings that alone make possible additions to the ranks of labor?

The lack of co-operation of management, capital and labor is manifested in the labor disturbances of the past and the strikes threatened for the future—strikes for the most part authorized, not by a secret ballot offering protection to the man casting it, but a ballot taken under conditions exposing the voter to the retaliation of the malcontent and a count made, not under conditions of publicity and supervised by responsible officers of the state, but made by officers of the unions in backrooms of hotels without supervision and carrying no assurance of integrity. It would be very interesting if we could have a strike vote taken under the conditions upon which we insist in our political affairs—a secret ballot and an honest count.

While we as a people exalt knowledge, its value is apt to be exaggerated. It is after all a kind of raw material, collected from various sources and retained largely through feats of memory. The significant thing is intelligence, the potentiality of the human machine, the ability to learn, to think quickly and accurately, to analyze a situation, to maintain a state of mental alertness and to comprehend and follow instructions. It is not because you men have education, but because you have intelligence that you occupy administrative positions of authority, and it is to the extent that you exercise this intelligence in the conduct of the affairs entrusted to you that we count with hope on overcoming the difficulties with which we are beset. What we look to find in you is a great fund of common sense, a power of knowing or hitting the mark as to things and ideas, the impression of the real, cautious, critical, shrewd and well-balanced, a sort of curb and correction of the errors that education and history so often produce.

Your two great assets are self-knowledge and self reliance, and these you should assiduously cultivate. You are engaged in a great and noble occupation, citizens of the greatest and finest of countries, both offering to you and to your children the most unbounded opportunities.

But you carry responsibilities heavy as these blessings are large. The realization of the one is dependent upon your attitude toward the other.

CLOSING BUSINESS

OTHER FEATURES of the convention included a meeting on Tuesday evening at which moving pictures of the supply train method of distributing materials and supplies in vogue on the Southern Pacific were shown. On Thursday afternoon the members were taken by a special train through the Chicago terminals of the Chicago & Western Indiana to the classification yard at Clearing and thence to the reclamation plant of the Atchison, Topeka & Santa Fe at Corwith.

The closing business included the consideration of the amendments referred to in the opening paragraphs of this report, these amendments being passed by a large majority. The election of officers resulted in the following selections: President, L. M. Denney, supervisor, Cleveland, Cincinnati, Chicago & St. Louis, Indianapolis, Ind.; first vice-president, J. P. Corcoran, roadmaster, Chicago & Alton, Bloomington, Ill.; second vice-president, J. B. Martin, supervisor, New York Central, Elkhart, Ind.; secretary, P. J. McAndrews, roadmaster, Chicago & North Western, Sterling, Ill.; treasurer, T. F. Donahoe, general supervisor, Baltimore & Ohio, Pittsburgh, Pa.; members of the Executive Committee selected for four years, J. W. Koontz, roadmaster, Delaware & Hudson, Carbondale, Pa.; C. A. Joyce, track supervisor, Erie, Patterson, N. J.; member of the Executive Committee to fill a vacancy through the advancement of Mr. Martin to vice-president, W. F. Muff, roadmaster, Atchison, Topeka & Santa Fe, Newton, Kan. Cleveland was selected as the place for holding the next convention.

The following topics submitted by the Committee on Subjects were approved by the convention for the consideration of committees during the ensuing year: (1) Unit cost data on track work operations, with suggested forms for the collection of data; (2) the maintenance of motor cars; (3) the most economical methods of installing ties; (4) the relative merits of small section gangs supplemented by floating gangs and large section gangs for routine maintenance work, and (5) the proper sizes of stone ballast.

THE TRACK SUPPLY EXHIBIT

THE EXHIBIT of track appliances and maintenance of way materials which was held under the auspices of the Track Supply Association was the most successful in the history of this association, this being the tenth exhibit to be held by this organization of manufacturers. A total of 58 firms presented displays, this being one of the largest exhibits ever held, while the number of firms holding membership was increased to 70. The arrangement whereby the exhibit could occupy a large room adjacent to the convention hall made the location most favorable from the standpoint of both the exhibitors and the railway men attending the convention.

The officers of the association for the past year were as follows: President, D. T. Hallberg, assistant general sales agent, The P. & M. Company, Chicago; vice-president, H. T. Potter, sales manager, The Wyoming Shovel Works, Wyoming, Pa.; secretary-treasurer, W. C. Kidd, Ramapo Iron Works, Hillburn, N. Y.; director ex-officio, W. H. Armstrong, manager tie tamper department, Ingersoll-Rand Company, New York; advisory director, E. T. Howson, editor, *Railway Maintenance Engineer*, Chicago; directors, A. Chapman, western sales manager, The Rail Joint Company, Chicago; F. M. Condit, manager railroad department, Fairbanks, Morse & Co., Chicago; J. J. Cozzens, salesman, Union Switch & Signal Co., New York, and Arnold H. Told, general manager, Positive Rail Anchor Company, Marion, Ind.

The names and addresses of the firms exhibiting, the devices and materials shown and the names of the representatives in attendance are given below:

Addressograph Company, Chicago; addressograph and graphotype machines; W. G. Ryan, J. E. Miles and E. F. Steffen.

Air Reduction Sales Company, New York; welding and cutting torches, acetylene, oxygen, samples of welded switch points and welded rail ends; H. H. Melville, A. W. Brown, Edward L. Fiddyment and A. B. Brown.

American Chain Company, Reading Specialties division, New York; rail clamps, derailers, rail benders; A. H. Weston and J. J. O'Connell.

American Hoist & Derrick Company, St. Paul, Minn.; photograph of ditchers; W. B. Maurer and Miss H. Holler.

American Steel & Wire Company, Chicago; fence posts, woven wire fencing; L. P. Shanahan, M. E. Evans, D. R. Waterman and John Collins.

American Valve & Meter Company, The, Cincinnati, Ohio; switch stands and track appliances; J. T. McGarry, F. C. Anderson and Dan J. Higgins.

Anchor Company, Chicago; rail anti-creepers; Orlando Metcalf and G. H. Chadwell.

Balkwill Manganese Crossing Company, Cleveland, Ohio; model of an articulated manganese steel crossing; S. Balkwill.

Bethlehem Steel Company, Bethlehem, Pa.; switch stands; Neil E. Salsich, R. W. Gillispie, E. H. Gumbart, R. E. Belknap and J. F. Hennessy.

Bucyrus Company, South Milwaukee, Wis.; moving pictures of spreader plow and other excavating machinery; E. G. Lewis, H. M. Swigart, H. L. Palmer, G. A. Morrison, M. J. Woodhull and Morgan Bogart.

Carbic Manufacturing Company, Duluth, Minn.; acetylene lights, welding generator and welding cutting equipment, motor car lights; A. D. Guthrie, D. C. Duncan and C. H. Bolinder.

Chicago Malleable Castings Company, Chicago; rail anchor tie plate, tie plate with key, rail anchor tie plate with key, rail clips; Warren Osborn, J. S. Llewellyn, A. R. Anderson and W. L. Beaudway.

Chicago Manufacturing and Distributing Company, Chicago; ratchet track bolt wrench, ratchet screw spike wrench and ratchet wrenches for all purposes; J. A. Slater, B. W. Conlin, J. D. Hiatt, H. I. Hiatt and R. J. McKee.

Creepcheck Company, The, Hoboken, N. J.; rail anchors; P. E. Browne and John T. Reagan.

Crerar, Adams & Company, Chicago; bonding drill, track drill, rail saw, die starters, jacks, snow brooms, shovels, etc.; Russell Wallace, G. D. Bassett, E. C. Poehler, W. I. Clock, J. A. Martin, C. W. Gregory and E. Mahlke.

Duff Manufacturing Company, The, Pittsburgh, Pa.; jacks; C. N. Thulin and E. E. Thulin.

Elliot Frog & Switch Company, East St. Louis, Ill.; guard rail clamps, switch stands and switch rods; H. J. Elliot and W. J. Fairback.

Emulsified Asphalt Company, Indianapolis, Ind.; model of asphalt highway crossing; C. E. Jefferson.

Fairbanks, Morse & Co., Chicago; spike puller, track wrench; A. A. Taylor, B. S. Spaulding, L. H. Matthews, E. C. Golladay, F. J. Lee, F. M. Condit, G. W. Lewis, H. L. Hilliary and P. H. Gilleland.

Fairmont Gas Engine & Railway Motor Car Company, Fairmont, Minn.; model of gas engine for motor car; H. E. Wade, W. F. Kasper and W. D. Brooks.

Frictionless Rail Company, Boston; models and photographs of frictionless rail; S. W. Simons and John W. McManama.

Hauck Manufacturing Company, Brooklyn, New York; thawing outfits, kerosene torches, circular flame burners, blue flame oil burners and syphon type furnace burner; Willis C. Squire.

Hayes Track Appliance Company, Richmond, Ind.; derail and model showing a cross-section of actual operation; H. J. Mayer, S. W. Hayes, O. M. Kendall, H. H. Jenkins and R. H. Guasepohl.

Headley Good Roads Company, Philadelphia, Pa.; bituminous railroad crossing; F. X. Kern.

Ingersoll-Rand Company, New York; tie tamper, air tools for track work; W. H. Armstrong, J. N. Thorp and J. P. Gillies.

Kalamazoo Railway Supply Company, Kalamazoo, Mich.; light inspection motor car; J. J. McKinnon, F. E. McAllister, W. E. Wintere and H. R. Miller.

Kilbourne & Jacobs Manufacturing Company, Columbus, Ohio; photographs of automatic air dump car with apron attachment; Jay N. Markel.

Lundie Engineering Corporation, The, New York; tie plates; W. S. Boyce and W. Brooke Moore.

Maintenance Equipment Company, Chicago; friction car stop, steel fence post, blue flag derail, rail layer, ballast screen, switch point straightener, tie spacer; H. C. Holloway, J. A. Roche and Ray Downey.

Mudge & Company, Chicago; railway motor car; Karl J. Eklund, Clyde P. Benning, John M. Mulholand and Burton Mudge.

National Lock Washer Company, The, Newark, N. J.; nut locks, demonstrating model of rail section imitating action of nut locks in service; J. Howard Horn, R. L. Cairncross and A. T. Thompson.

National Malleable Castings Company, Cleveland, Ohio; wrecking hook, malleable iron washers, rail braces and tie plates; J. A. Slater, G. R. Rasmussen, C. H. Krakau and L. S. Wright.

North Western Motor Company, Eau Claire, Wis.; railway motor cars and engines; F. W. Anderson, R. R. Rosholt and A. H. Nelson.

Oxweld Railroad Service Company, The, Chicago; reclamation of track materials by the oxy-acetylene process; W. H. Kofmehl, L. C. Ryan and C. M. Marshall.

P. & M. Company, The, Chicago; rail anchors and anti-creepers; S. M. Clancey, G. E. Johnson, P. V. Samuelson, D. T. Hallberg, J. J. Gallagher and J. E. Mahoney.

Pocket List of Railroad Officials, The, New York; Charles L. Dinsmore.

Track Specialties Company, New York; spike, insulated bolts, guard rail clamp, rail brace, compromise joint, rail joint, anchor plate, insulated joint, tie plate, derail, car stop, car replacer, etc.; John A. Bodkin.

Union Switch & Signal Company, Swissvale, Pa.; insulated rail joint; J. J. Cozzens and George Marloff.

Verona Tool Works, Pittsburgh, Pa.; railroad track tools, nut locks, rail joint springs; E. Woodings, P. L. Laughlin, W. W. Glosser, A. T. Richardson, F. B. Nimmo and J. S. Wincrantz.

Warren Tool & Forge Company, Warren, Ohio; track tools, etc.; H. C. Mull and George Konold.

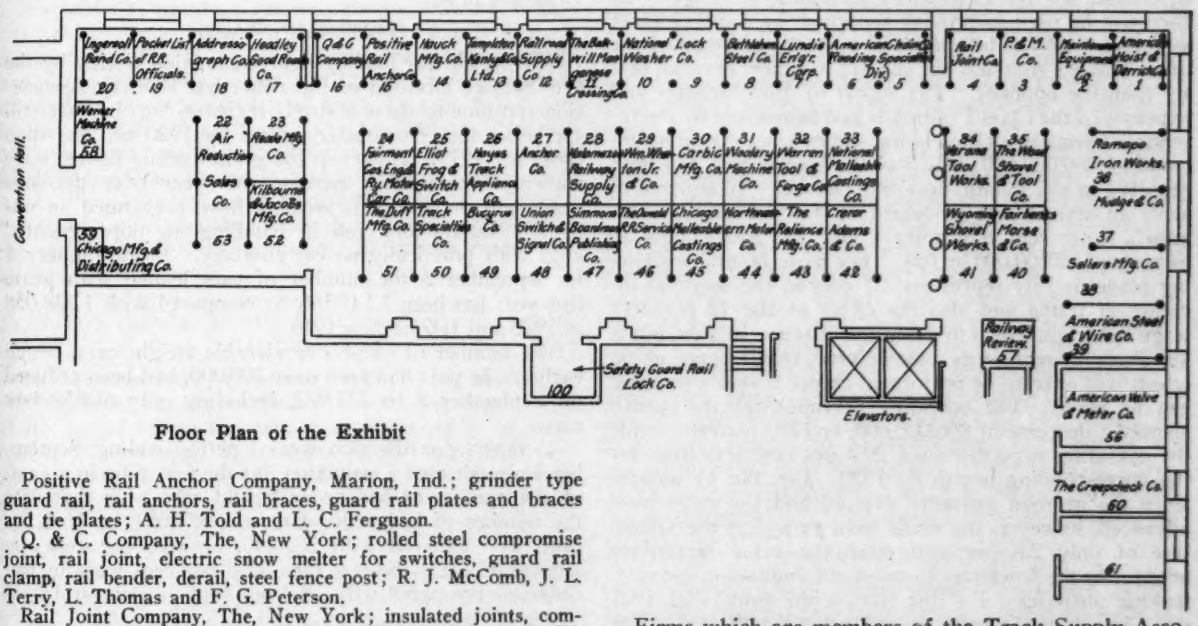
Werner Machine Company, Inc., West Allis, Wis., spike shaper; E. J. Wind and F. A. Gardner.

William Wharton, Jr., & Co., Inc., Easton, Pa.; manganese steel one-piece guard rail, photograph of No. 10 manganese steel rail-bound frog; H. F. McDermott, S. G. Llewellyn, Victor Angerer, George R. Lyman, J. H. Hock and F. H. Lehecka.

Woolery Machine Company, Minneapolis, Minn.; gas engine; H. E. Woolery.

Wyoming Shovel Works, The, Wyoming, Pa.; track shovels, spades, scuffle hoes and picks; H. T. Potter, Stanley H. Smith, G. E. Geer and E. L. Ruby.

Wood Shovel & Tool Company, Piqua, Ohio; shovels, spades and scroops; C. L. Butts and M. H. Lytle.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Safety Guard Rail Lock Co. 100
Elevators.
Convention Hall.
59 Chicago Mfg. & Distributing Co.

Floor Plan of the Exhibit

Positive Rail Anchor Company, Marion, Ind.; grinder type guard rail, rail anchors, rail braces, guard rail plates and braces and tie plates; A. H. Told and L. C. Ferguson.

Q. & C. Company, The, New York; rolled steel compromise joint, rail joint, electric snow melter for switches, guard rail clamp, rail bender, derail, steel fence post; R. J. McComb, J. L. Terry, L. Thomas and F. G. Peterson.

Rail Joint Company, The, New York; insulated joints, compromise joints and standard joints; Charles Jenkinson, R. W. Payne, Thomas Ryan, Alex Chapman, G. H. Larson, G. T. Willard and C. B. Griffin.

Railroad Supply Company, The, Chicago; tie plates and derails; A. H. Smith, E. P. Gowing, G. W. Nibbe and M. J. Fox.

Railway Review, Chicago; copies of paper; W. M. Camp, Harold A. Smith, Arthur E. Hooven and C. L. Bates.

Ramapo Iron Works, Hillburn, N. Y.; switch stand, double shoulder switch plates, manganese switch point; W. C. Kidd, R. J. Davidson, Jr., J. B. Snow, J. B. Strong and T. E. Akers.

Reade Manufacturing Company, Jersey City, N. J.; photograph of chemical weed killing machine; R. H. Bogle and W. L. Geggus.

Reliance Manufacturing Company, The, Massillon, Ohio; nut locks; H. C. Mull and H. J. McGinn.

Safety Guard Rail Lock Company, Orlando, Fla.; guard rail lock; Willie L. Daugherty.

Sellers Manufacturing Company, Chicago; tie plates; G. M. Hogan, T. D. Crowley and R. A. Van Houten.

Simmons-Boardman Publishing Company, New York; samples of papers and cylopedias; L. B. Sherman, E. T. Howson, W. S. Lacher, Milburn Moore, F. H. Thompson, F. C. Koch, D. A. Steel, B. J. Wilson, J. M. Rutherford, R. H. Smith and James Currie.

Superior Supply Company, Chicago; literature on concrete mixers; John B. Seymour, C. A. Gieles, J. H. Erby and W. R. Sostheim.

Templeton, Kenly & Company, Ltd., Chicago; track jacks, car jacks, pole jacks and emergency jacks; L. E. Allen, W. D. Templeton, S. A. Nelson and A. C. Lewis.

Firms which are members of the Track Supply Association but which did not occupy exhibit space are listed below:

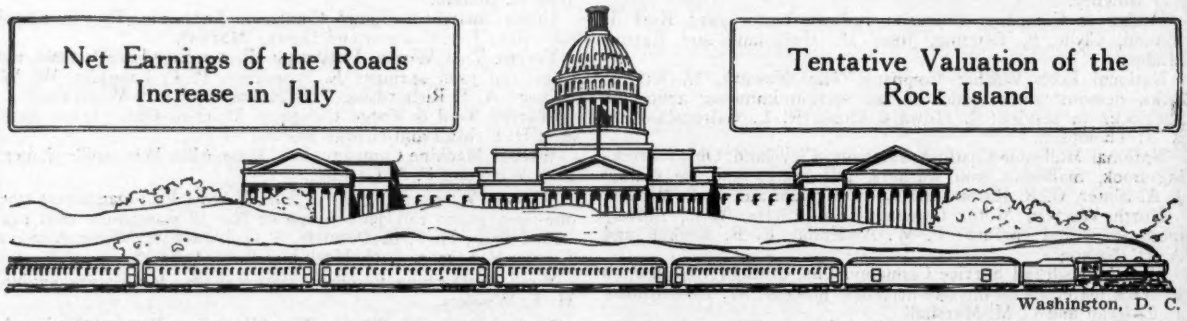
Ajax Forge Company, Chicago.
Buda Company, Chicago.
Chipman Chemical Engineering Company, New York.
Cleveland Frog & Crossing Company, Cleveland, Ohio.
Dilworth Porter & Co., Inc., Pittsburgh, Pa.
Dressel Manufacturing Corporation, New York.
Hurst Railway Switch & Signal Company, St. Louis.
Industrial Track Construction Company, Chicago.
Morden Frog and Crossing Works, Chicago.
Pettibone, Mulliken Company, Chicago.
Railway Purchases and Stores, Chicago.
Railway Safety Tie Company, Milwaukee, Wis.
Southern Hardware & Supply Company, St. Louis.
St. Louis Frog & Switch Company, St. Louis.

At the annual meeting held on Wednesday morning the following officers were elected for the ensuing year. President, Herbert Potter, Wyoming Shovel Works, Wyoming, Pa.; vice-president, F. M. Condit, Fairbanks, Morse & Co., Chicago; secretary-treasurer, W. C. Kidd, Ramapo Iron Works, Hillburn, N. Y.; directors, J. J. Cozzens, Union Switch & Signal Company, Swissvale, Pa.; K. J. Eklund, Mudge & Co., Chicago; Alex Chapman, Rail Joint Company, Chicago, and A. H. Told, Positive Rail Anchor Company, Marion, Ind.

RAILWAY AFFAIRS AT THE NATION'S CAPITAL

Net Earnings of the Roads Increase in July

Tentative Valuation of the Rock Island



Washington, D. C.

MANY indications of a general improvement in the railroad situation are being observed in the various reports which are sent to and compiled at Washington. The condition shown by these reports is, of course, not yet satisfactory and there is danger that they will be used as proving too much by some of those who find it easy to be optimistic as to the outcome of the other fellow's troubles, but any improvement is much better than the opposite. The report of July earnings and expenses of the Class I railroads just announced by the Interstate Commerce Commission shows a net operating income of $69,000,000, which is the largest that has been reported in any month since last October. It also represents an annual rate of return of 4½ per cent, but to earn a 6 per cent return for a year the roads ought to earn about $93,00,000 in July. The more favorable showing made in July represents, of course, the seasonal increase in traffic and also the effect of the 12 per cent wage reduction which first became effective in July, but it also probably represents some deferred maintenance work, which will have to be performed before a year's showing can be made. The operating revenues for the month showed a decrease of $66,000,000, or 12½ per cent, while the operating expenses were 29.4 per cent less than for the corresponding month of 1920. For the 11 months since the railroad guaranty expired and the rates were advanced, however, the roads have earned at the annual rate of only 2.6 per cent upon the value tentatively adopted by the Interstate Commerce Commission for rate-making purposes. For the first seven months of 1921 the Class I roads have earned net $213,000,000. The operating revenues for this period were $130,000,000 less than in the corresponding period of 1920 and there was a reduction of $360,000,000 in operating expenses, part of which represents economy, part represents the effect of less traffic and part represents deferred maintenance. For the seven months' period the expenditures for maintenance of way and structures were $435,000,000, as compared with $549,000,000 last year, and the expenditures for maintenance of equipment were $737,000,000, a decrease of $111,000,000.

Commission Has Tentative Consolidation Plan

The Interstate Commerce Commission is expected to promulgate shortly its tentative plan for the consolidation of the railways of the United States into 20 competing systems. While the transportation act was pending in Congress the Senate passed a bill providing for a compulsory consolidation of the roads into not less than 12 or more than 25 systems, but the House bill provided only for permissive consolidations. The conference report which was adopted provided that the commission should prepare a plan and that any voluntary consolidations proposed by the roads themselves should not be approved unless in harmony with the commission's plan. The commission engaged Prof. W. Z. Ripley, of Harvard University, to assist it in the preparation of a tentative plan on which public hearings are to be held and it will be made public as soon as it comes from the printer.

Traffic Increasing

The freight car loading figures compiled weekly by the Car Service Division of the American Railway Association continue to show a steady increase, but they are still far below the comparative figures for 1920 and less than those for 1919. However, the grain loading figures have shown a remarkable increase this year over previous years and the railroads seem to have performed an unusually satisfactory job in handling an unprecedented crop with practically no car shortage. From January 1 to September 3 the number of cars loaded with grain this year has been 1,547,586, as compared with 1,238,058 in 1920 and 1,471,598 in 1919.

The number of surplus serviceable freight cars, which early in the year had been over 500,000, had been reduced on September 8 to 237,972, including only 65,858 box cars.

A report for the two weeks' period ending September 1 also showed a reduction, for the first time in a year, of the number of bad order freight cars. On that date the number of bad order cars was 374,087, or 16.2 per cent, as compared with 382,440, or 16.6 per cent, on August 15. Of the box cars, 17.8 per cent were in bad order, as compared with 18.2 per cent on August 15.

Rate Reductions

A number of important reductions in freight rates have recently been announced by the Interstate Commerce Commission as a result of conferences between the commission, the railroads and the shippers. On September 10 the commission approved heavy reductions on five days' notice in interstate freight rates on sand, gravel and crushed stone between practically all points in trunk line territory, including Pennsylvania, New Jersey, Delaware, Maryland and parts of West Virginia and Virginia. The new rates were to go into effect on October 1 and will be approximately 15 per cent higher than the rates in effect prior to the general increase of August, 1920, thus substituting a 15 per cent increase for a 40 per cent increase. The amount of the saving to the shippers was estimated at a number of million dollars a year.

On September 20 the commission announced that, after a conference between representatives of the transcontinental carriers, western vegetable shippers and the commission, a decision had been reached to make reductions desired by the shippers in the rates on vegetables from California and other Pacific Coast territory points to the territory east of the Rocky Mountains as far as Chicago and the Mississippi river. The basis to be employed is

to substitute for the increase of 33⅓ per cent made on August 26, 1920, an increase of 15 per cent over the rates in effect prior to the general increase, thus removing more than half of the increase made at that time.

Railroad Administration Sells Equipment Securities

While the legislation intended to bring about an early settlement of the accounts between the railroads and the government arising from the period of federal control has been delayed by the Congressional recess, certain steps for the purpose of providing funds which the Railroad Administration may use in settling with the roads have been taken in the meantime. The Railroad Administration holds over $300,000,000 of 6 per cent equipment trust certificates which it accepted from the roads in payment for the standard cars and locomotives ordered during the period of federal control, which under the law it may not sell at less than par and accrued interest. The bill which has passed the House and is now pending in the Senate would authorize the War Finance Corporation to purchase these and other railroad securities held by the government and to hold them until market conditions are favorable. During the recess an effort was made to test the market and it was found that some of the best of these certificates could be sold at par and interest at the present time. On September 12 it was announced that the director general of railroads had sold $7,500,000 of certificates to Kuhn, Loeb & Co., of New York, through the agency of the War Finance Corporation, and on September 19 announcement was made of the sale of $20,204,000 additional to various banks and an insurance company.

Tentative Value of the Chicago, Rock Island & Pacific

The first tentative valuation report to be served by the Interstate Commerce Commission in the case of one of the larger railroad systems was made public on September 10, covering the Chicago, Rock Island & Pacific and its subsidiary and affiliated lines. The used property devoted to common carrier purposes is given a "final value" of $322,277,596 as of the valuation date, June 30, 1915.

However, to make a comparison between the valuation of the property and the present outstanding capitalization, it is necessary to take into account the property of other corporations, the stock of which is held by the Rock Island, and add to this the additions and betterments made since the date of valuation. This will be readily understood from the statement below:

Final Tentative Valuation

Final value C. R. I. & P.	$322,277,596
Final value C. R. I. & G.	13,312,667
Morris Terminal	48,750
Total I. C. C. valuation as of June 30, 1915	$335,639,013
Additions and betterments June 30, 1915, to December 31, 1920	34,715,482
Valuation for rate making purposes to date	$370,354,595

Capital Liabilities

Capital stock outstanding	$129,040,511.50
Funded debt	229,975,796.51
Debt to affiliated companies	313,564.09
Total capital liabilities	$359,329,872.10

Comparing the final valuation for rate-making purposes with the total capital liabilities, we find a difference of $11,024,723 in favor of the valuation. This sum is subject to more or less adjustment as a consequence of pending settlement with the United States government.

ACTIVITIES OF THE RAILWAY LABOR BOARD

THE RIGHT of a section foreman to maintain membership in a union organization with his men was sustained by the United States Railroad Labor Board in a decision handed down on September 12 in a controversy brought before it by the United Brotherhood of Maintenance of Way Employees and Railway Shop Laborers against the Butler County Railroad, a small line in southeastern Missouri. The two foremen involved in the decision were discharged by the railway on December 18, 1920, because of the fact that they belonged to the same labor union to which the men under them belonged. The company maintained that it was within its legal right in taking this step, saying that it "has always insisted upon exercising entire freedom of action in selecting its subordinate officials. It does not inquire who among the men belong to labor unions or who do not, but the management feels that the economic interests of the public and of the corporation and, in fact, public safety, require for the company the widest freedom of action in the selection of those who are to direct the work of the section men and see that their duties are expeditiously, economically and properly performed, and to attain that result it is entitled to and must have the undivided allegiance of the foremen."

After discussing at length the provisions of the Transportation Act, under which it is functioning, and expressly placing the responsibility for its decision upon Congress which enacted the law which it is endeavoring to carry out, the Board decided that the action of the carrier in discharging these foremen "for the causes named was unfair, unjust and unreasonable and they shall in justice be reinstated, and placed in full enjoyment of such seniority rights, if any, as the rules or practices existing on the carrier in question guarantee, provided they report for assignment within 15 days from date of this decision. They should be reimbursed for losses suffered, less the amount earned since date of dismissal, provided there was on this carrier an existing rule or established usage guaranteeing to employees pay for loss occasioned by unjust suspension or dismissal.

Other Developments

The Labor Board on September 19 ordered further hearings on September 26 in the controversy between the Pennsylvania and its shop employees, developments in which were outlined briefly in the *Railway Maintenance Engineer* for August and September. An August 24 the Pennsylvania requested the Labor Board to: (1) Vacate its decision of July 26 directing the Pennsylvania to confer with officers of the Federated Shop Crafts and hold new elections for employees' representatives to negotiate new rules and working conditions. (2) Establish the fact that the carrier has the legal right under the Transportation Act to establish new rules and working conditions. (3) Ratify the agreements already made between the Pennsylvania and its employees. (4) Grant an oral hearing at which the carrier could offer further testimony in support of its position.

The announcement of the Board ordering further oral hearings gives the Pennsylvania permission to present evidence: (1) As to what employees not in actual service of the carrier may vote in the election of employees' representatives to conduct negotiations with the road. (2) As to how the representative capacity of spokesmen of unorganized employees shall be ascertained, and (3) On the adoption or ratification of the rules already negotiated.

The Board took the opportunity presented by this

case to outline in detail its interpretation of the labor provisions of the Transportation Act and to express its opinion of the manner in which the Pennsylvania has handled labor matters in the past few months. The position of the Pennsylvania in this case is analyzed in the order, the Labor Board disagreeing with practically all of the contentions held by the carrier and outlined in previous hearings and in the carrier's petitions to the Board.

On September 26 President Rea of the Pennsylvania notified the Board that inasmuch as the Board had restricted testimony for the hearing, to be held on that day, to matters on which he felt that the Board had no jurisdiction he deemed it unnecessary for the Pennsylvania to appear.

Threats of strike have again been spread broadcast by various labor organizations, particularly the train service brotherhoods and the Railway Employees' Department of the American Federation of Labor, which comprises the Federated Shop Crafts. Although many railway executives hold to the belief that because of existing conditions there will be no walkout at this time, the labor organizations continue to carry on strike propaganda. Indications at the present time are, however, that there will be no serious trouble at least until traffic is again normal and the subject of new rules and working conditions has been definitely decided by rulings of the Labor Board. It is the contention of officers of the Federated Shop Crafts that a strike on their part would have more likelihood of success if this move is made as a protest against both reductions and basic wages and changes in rules and working conditions.

ASSOCIATION ACTIVITIES

AMERICAN RAILWAY ENGINEERING ASSOCIATION

Many of the committees have held meetings during the last month, and have undertaken the preparation of the final drafts of their reports which will be presented before the annual convention of the association next March. Among the more extended meetings which will be held in the near future is one of the Yards and Terminals committee, which will spend three days at Detroit studying the terminals in that city. The proceedings of the 1920 convention have come from the press and are now being distributed to the members.

BRIDGE AND BUILDING ASSOCIATION

Most of the committees of this association have completed their work and the reports are in the hands of the secretary for publication. Plans are also practically completed for the annual convention, which will be held at the McAlpin hotel, New York, on October 18-20, inclusive. Those members from Chicago and points west will travel to the convention on a special train via the Michigan Central and the Delaware, Lackawanna & Western, leaving Chicago on Sunday evening, October 16. The train will stop a short time at Niagara Falls, N. Y., and also at the Tunkhannock viaduct and other points of recent construction interest on the Lackawanna, arriving at New York on Monday evening.

AMERICAN WOOD PRESERVERS' ASSOCIATION

The executive committee and several other committees met in separate sessions at Chicago on September 20, joining in a dinner at the Sherman hotel that evening, at which approximately 50 were present. The executive committee gave special attention to the newly formed service bureau and to the completion of plans for the annual convention, which will be held in Chicago in January.

THE MATERIAL MARKET

THE LAST month in the iron and steel market has been marked by a break in the continual depression in that some of the manufacturers have announced advances of 10 cents per 100 lb. in the price of wire and 15 cents in the price of wire nails. Prices have also been pushed upward to some extent in the case of sheet steel. This is in contrast with the condition of the rest of the market, which is now either stationary or being slowly depressed. However, it must be said that the only official drop recorded has been in the schedule of prices for wrought steel pipe, which have been marked down $8 to $10 a ton.

In the meantime prices have become more and more competitive, resulting in a virtual disappearance of the Pittsburgh base. This is indicated by the fact that Chicago prices for track bolts, track spikes and structural steel material are now appreciably less than the Pittsburgh price plus the freight from Pittsburgh to Chicago, and that the fixed prices which were established by the manufacturers some time ago have now virtually disappeared from market quotations. As a consequence the price list below for September 20 contains only what are believed to be the actual prices, although large orders will probably bring out prices somewhat below those given.

	Price in Cents Per Pound			
	August 18		September 20	
	Pittsburgh	Chicago	Pittsburgh	Chicago
Track spikes	$2.50 to $2.75	$3.23	$2.50	$2.78
Track bolts	3.25 to 3.80	$3.88 to 4.23	3.78	3.78
Angle bars		2.75		
Tie plates, steel	2.00 to 2.05	2.00 to 2.25	2.00	2.00
Tie plates, iron		2.00 to 2.25		2.00
Plain wire	2.50	2.88	2.60	2.98
Wire nails	2.75	3.13	2.90	3.28
Barbed wire, gal.	3.40	3.78	3.55	3.93
C. I. pipe, 6 in. or larger, per ton		42.60 to 45.60		44.10
Plates	1.70 to 1.85	1.85 to 2.23	1.70	1.85
Shapes	1.85	1.85 to 2.23	1.75	1.85
Bars	1.75	2.03 to 2.13	1.70	1.90

No appreciable change has been noted in the price of scrap.

	Per Gross Ton	
	Chicago	St. Louis
Relaying rails	$27.50 to $30.00	$29.00 to $30.00
Rerolling rails	13.00 to 13.50	12.00 to 12.50
Rails less than 3 ft. long	12.50 to 13.00	11.00 to 11.50
Frogs and switches cut apart	11.00 to 11.50	11.00 to 11.50
	Per Net Ton	
No. 1 railroad wrought	11.50 to 12.00	10.50 to 11.00
Steel angle bars	10.50 to 11.00	9.00 to 9.50

Very little change has been noted in the lumber market. There has been a slight upturn for some prices, especially for Southern pine, but the general tendency is to depress the prices still further. Douglas fir prices are generally the same as they were a month ago.

SOUTHERN MILL PRICES

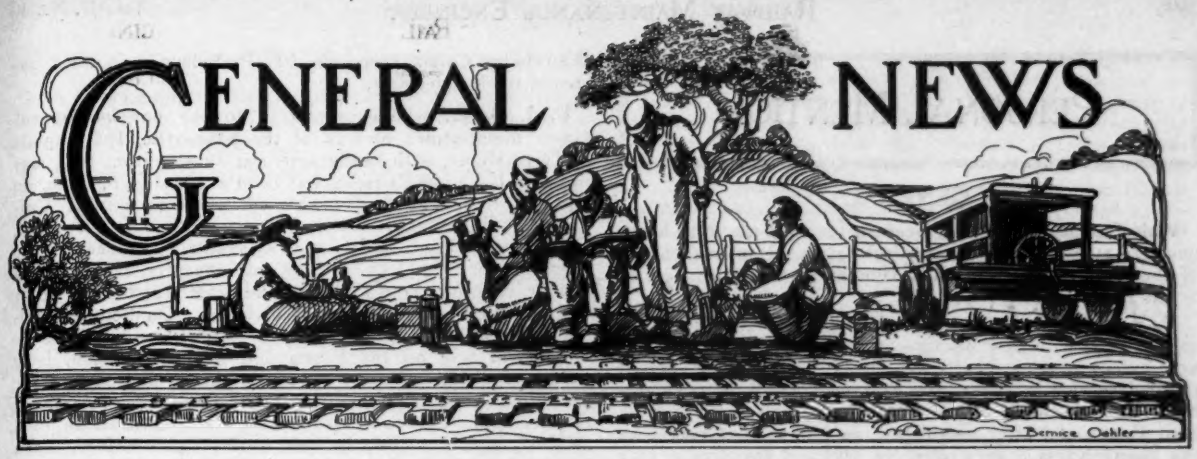
	August	September
Flooring, 1x4, B. and B. flat	$31.58	$34.30
Boards, 1x8, 14 and 16, No. 1	18.96	23.65
Dimension, 2x4, 16, No. 1	20.90	18.90
Dimension, 2x10, 16, No. 1	21.34	20.50
Timbers, 4x4 to 8x8, No. 1	19.23	18.25
Timbers, 3x12 to 12x12, No. 1	24.25	21.90

DOUGLAS FIR MILL PRICES

Flooring, 1x4, No. 2, clear, flat	$21.00	$21.00
Boards, 1x6, 6 to 20, No. 1, common	10.50	9.50
Dimension, 2x4, 16, No. 1, common	10.50	11.00
Dimension, 2x10, 16, No. 1, common	10.50	11.00
Timbers, 6x6 to 8x8, No. 1, common	14.00	14.00
Timbers, 10x10 to 12x12, rough	13.00	13.00

No changes have been noted in the Portland cement market for some months, but on September 16 quotations were issued by the Universal Portland Cement Company, which ranged from 15 to 20 cents lower than those previously recorded. Prices at representative points between Pittsburgh and the Twin Cities are given below, these being the prices per barrel in carload lots, not including package.

Pittsburgh	$2.02	Milwaukee	$2.19
Detroit	2.31	Minneapolis	2.26
Chicago	1.97	Davenport	2.27
St. Paul	2.26	Cincinnati	2.37



On September 11 a fire in the Erie shops at Jersey City, N. J., destroyed one building, partially destroyed a second and damaged 18 locomotives. The estimated loss was $100,000.

The Railroad Administration will settle immediately the claims for damage sustained by 278 residents of Cloquet, Minn., in the forest fire of October 12, 1918, at 50 cents on the dollar.

The Pere Marquette has applied for authority to abandon its line extending from Harrison, Mich., to Leota, a distance of approximately 10 miles, this line having been built originally to take care of a lumber business which is now practically exhausted.

The average number of employees for Class I roads for the three months ending June 30 was 1,568,143, as compared with 1,691,471 in the first quarter of 1921. In the third quarter of 1920, when the number of employees was at the maximum, the total was 2,157,989.

The amount of damage done to the Southern Pacific of Mexico during the revolutionary period is placed at $12,000,000 by the Southern Pacific. An engineer for the Mexican Government, on the other hand, has placed the estimated amount of damages at $7,000,000.

The Pacific Great Eastern is now in operation to Williams Lake, about 300 miles north of Vancouver, and track has been laid to Quesnel, about 50 miles beyond Williams Lake and about half the distance thence to Fort George, B. C., the proposed northern terminus, which is on the Grand Trunk Pacific.

The approval of the English Government is now being sought for the purpose of constructing a tunnel under the Thames river east of London in order to permit the railways in the east of England to move traffic north and south without having to pass through London. The tunnel proposed is 2¼ miles in length and will cost approximately $25,000,000.

The block signal mileage of the railroads of the United States, according to the annual statement of the Interstate Commerce Commission, comprises 101,883.6 miles of road, this figure being the sum of 38,943.9 miles of automatic equipped road and 63,339.7 miles of manual equipped road. The same report shows that the telephone is in use for the transmission of train orders on 122,022 miles of road.

What is said to be the longest freight train ever operated in the state of Michigan was run by the Ann Arbor from Owosso, Mich., southward to Toledo, Ohio, on August 7. This train consisted of 53 loads and 97 empties. It weighed 3,932 tons and with the exception of a four-mile stretch out of Owosso was hauled over the entire 104 miles by a single Santa Fe type locomotive with 70,000-lb. tractive effort.

Portland cement was produced in greater quantity during 1920 than any previous year. The total for the year was 100,023,245 barrels, exceeding that in 1917, the next highest year in production, by 7,209,043 barrels. This amount was an increase of 24 per cent over the production in 1919—80,777,935 barrels. The stocks at the mills increased from 5,256,900 barrels at the end of 1919 to 8,941,046 barrels at the end of 1920.

Reports from varied parts of the country indicate that the railroads everywhere are experiencing considerable trouble from tramps, reports from some sections indicating that the number of tramps jumping trains is in excess of any number in previous years. Aside from traveling over the country with but little interference on the part of the police organizations of the smaller towns, these tramps are presenting much interference to the proper operation of trains and in many instances present a constant source of danger to train crews in charge.

Secretary Hoover of the Department of Commerce has announced the names of those invited by the President to attend a conference at Washington, beginning on September 26, to inquire into the volume and distribution of unemployment, and to consider measures that would tend to encourage recovery of business. The members invited include: C. H. Markham, president of the Illinois Central; W. S. Carter, president of the Brotherhood of Locomotive Firemen and Enginemen, and Edgar E. Clark, ex-chairman of the Interstate Commerce Commission.

The railroads in the vicinity of San Antonio, Tex., suffered heavy damage as a result of the cloud-burst in southern Texas on September 9 and 10. The Missouri, Kansas & Texas lost approximately 500 ft. of bridge approaches between Temple and Taylor, and the line between Austin and Ranger suffered such damage in the way of bridge washouts as to prevent passage of traffic over a portion of it for more than a week. The Southern Pacific also encountered several washouts and the Texas-Mexican suffered particularly heavy damage between Corpus Christi and Laredo.

The Boston & Maine, in order to meet motor truck competition which has assumed serious proportions in and about some of the cities, has inaugurated a plan whereby a reduction of from 33⅓ to 50 per cent has been made in the rates on certain express matter consigned to cities and towns within a distance of 50 miles of Boston. Furthermore the plan has been established whereby the local express companies pick up the traffic in the cities and distribute it when it reaches the destination. Thus far the reduction of rates is made to apply only when an individual car is assigned exclusively to the service.

A special election will soon be held in Kansas in which the residents of parts of two counties will decide whether passenger and freight service is to continue on the Leavenworth & Topeka, a railroad of approximately 45 miles, extending between Leavenworth and Meriden, and serving the town of Oskaloosa, the county seat of Jefferson County. The election will be held in accordance with a new Kansas state law which permits districts benefiting from railroad service to vote on tax levies deemed necessary to make the service profitable. The tax levy desired in the case is 2.5 mills, by means of which a fund of approximately $32,500 will be made available to the road to enable it to operate without a deficit.

PERSONAL MENTION

GENERAL

Walt Dennis, division engineer on the Wabash, with headquarters at Moberly, Mo., has ben appointed superintendent of the New Jersey, Indiana & Illinois, with headquarters at South Bend, Ind.

H. P. Kinney, who was recently appointed superintendent on the Erie, with headquarters at Dunmore, Pa., is an engineer by education and early experience. Mr. Kinney entered railroad service in June, 1910, as a member of an engineering corps engaged on the Key West extension of the Florida East Coast, and after completing an engineering course at the Pennsylvania State College in 1913 and spending a year in the employ of the J. G. White Engineering Corporation during its appraisal of the Atlantic Coast Line, he re-entered railroad service in the capacity of an assistant engineer on the Erie at Rochester. In 1916 he was appointed supervisor of the Greenwood Lake and Newark branches, and in October of the same year was promoted to division engineer of the Allegheny and Bradford division, with headquarters at Salamanca, N. Y. On May of the following year he was appointed assistant division engineer of the Buffalo, Allegheny and Bradford division, where he remained until August, 1918, when he was appointed trainmaster of the Buffalo division.

H. B. Titcomb, vice-president of the Pacific Electric, with headquarters at Los Angeles, Cal., who has been elected president of the Southern Pacific of Mexico and the Arizona Eastern, to succeed **Epes Randolph,** deceased, is an engineer by training. Mr. Titcomb was born at Indianapolis, Ind., in December, 1871, and graduated from the Cogswell Polytechnical College in 1891. In July of the same year he entered the service of the Southern Pacific as a draftsman and was promoted to assistant engineer in the construction division in 1898. In 1899 he was appointed roadmaster on the Western division and served successively as roadmaster on the Shasta and Sacramento divisions until 1904. From 1904 to 1905 he was assistant resident engineer and resident engineer at San Joaquin, Cal., from 1905 to 1906, and at Los Angeles from 1906 to 1909. In the latter year he was promoted to district engineer, with headquarters at Los Angeles, and in 1914 was promoted to maintenance of way assistant to the assistant chief engineer, with headquarters at San Francisco. In October, 1917, he was appointed superintendent of the Stockton division, with headquarters at Stockton, Cal., which position he held until September, 1918, when he resigned to become vice-president of the Pacific Electric, in which capacity he was serving at the time of his recent election, as noted above.

H. B. Titcomb

ENGINEERING

M. H. Gold has been appointed assistant division engineer on the Seaboard Air Line with headquarters at Tampa, Fla.

R. R. Bostwick, assistant engineer on the Canadian National with headquarters at Moncton, N. B., has been transferred to Toronto, Canada.

C. P. Richmond has been appointed assistant engineer on the New York, New Haven & Hartford with headquarters at Waterbury, Conn., succeeding **T. P. Polson,** appointed assistant track supervisor.

E. J. Bayer, whose promotion to the position of engineer maintenance of way of the Evansville, Indianapolis & Terre Haute, with headquarters at Washington, Ind., was noted in last month's issue, was born at Cincinnati, Ohio, on April 1, 1888, and received his education at Purdue University. He entered railway service with the Cleveland, Cincinnati, Chicago & St. Louis as assistant engineer of the Cairo division on July 5, 1910, subsequently serving in a similar capacity on the Peoria and Eastern, the St. Louis and the Cleveland-Indianapolis divisions. On September 1, 1914, Mr. Bayer was promoted to assistant engineer maintenance of way on the Peoria and Eastern division, later holding a similar position on the Michigan divison and the Cleveland-Indianapolis division. He was appointed acting engineer maintenance of way on the Cario division on June 24, 1918, which position he held until August 1, 1919, when he was appointed assistant engineer maintenance of way on the Cleveland-Indianapolis division, in which capacity he was serving at the time of his recent promotion.

J. W. Williams, whose appointment as chief engineer of the Western Pacific, with headquarters at San Francisco, was announced in the September issue of the *Railway Maintenance Engineer,* was born at Milan, Ohio, in 1879, and entered railroad service in 1897 as instrumentman on construction on the Albuquerque Eastern. He remained in the employ of this company on location and construction work until April, 1903, when he became transitman on location surveys for the Atchison, Topeka & Santa Fe, subsequently being promoted to assistant engineer in charge of location and construction in northern California. In 1906 Mr. Williams was appointed acting chief engineer of the San Francisco & Northwestern, with headquarters at San Francisco, and in 1907, when the Northwestern Pacific was formed, he was appointed assistant chief engineer, having charge of the field work on the construction of a line through the Eel River canyon. He held the latter position until July, 1914, when he was promoted to chief engineer of construction, which position he held until his recent appointment, except for a period during the war when he served overseas as a major of the First Battalion, Eighteenth Engineers, and subsequently as lieutenant-colonel.

J. W. Williams.

F. A. Benz, division engineer on the Buffalo, Rochester & Pittsburgh, with headquarters at East Salamanca, N. Y., has been transferred to Du Bois, Pa., succeeding **J. B. Oatman,** who has been appointed roadmaster, with the same headquarters, and the position of division engineer at East Salamanca has been abolished. The position of engineer of construction has been abolished and **D. S. Watkins,** who held that position, has been assigned to other duties.

H. O. Kelly, engineer of deferred maintenance on the staff of the chief engineer maintenance of way of the Wabash, with headquarters at St. Louis, has been promoted to division engineer at Moberly, Mo., succeeding **Walt Dennis,** resigned to accept service with another company. **J. T. Vitt,** assistant engineer at St. Louis, has been promoted to division engineer of the St. Louis Terminal division, succeeding **H. N. Huntsman,** who has been appointed assistant engineer on the Detroit division at Montpelier, Ohio, succeeding **S. N. Crowe. W. R. Bennett,** supervisor of the Chicago Terminal division at Chicago, has been promoted to assistant engineer at St. Louis, succeeding Mr. Vitt.

TRACK

John M. Reardon has been appointed assistant track supervisor on the New York, New Haven & Hartford with headquarters at New Haven, Conn.

H. Collins has been appointed acting roadmaster of the Deming district of the Southern Pacific, with headquarters at Deming, N. M., succeeding **T. A. Allen,** on sick leave.

E. E. Earl has been appointed acting roadmaster of the Klamath district of the Southern Pacific, with headquarters at Klamath Falls, in place of C. L. Crow, who has been granted sick leave.

J. A. Johnson, roadmaster on the Atlanta & West Point and the Western Railway of Alabama with headquarters at Atlanta, Ga., has had his territory extended to cover the Georgia Railroad.

H. E. Sanbourn, assistant supervisor of bridges and buildings, on the Boston & Albany with headquarters at Springfield, Mass., has been appointed supervisor of track with headquarters at Boston, Mass., succeeding **F. A. Jones,** transferred, as noted elsewhere in these columns.

John F. Williamson, roadmaster of the Yellowstone division of the Northern Pacific, with headquarters at Dickinson, N. D., has been promoted to division roadmaster, with headquarters at Glendive, Mont. Sam Carlson has been appointed roadmaster on the Yellowstone division, with headquarters at Dickinson, N. D., succeeding Mr. Williamson.

R. L. Longshore, supervisor of track on the Wabash, with headquarters at Montpelier, Ohio, has been transferred to Chicago, succeeding **W. R. Bennett,** promoted. **S. N. Crowe,** assistant engineer at Montpelier, has been appointed track supervisor, with the same headquarters, succeeding Mr. Longshore.

H. L. Bell has been appointed roadmaster on the Lufkin district of the Southern Pacific, with headquarters at Lufkin, Tex., in place of **J. H. Williams,** acting roadmaster, who has been promoted to roadmaster on the Shreveport district, with headquarters at Lufkin, Tex., succeeding **A. C. Weatherly,** assigned to other duties.

Luther L. Layton has been promoted to roadmaster on the Seaboard Air Line, with headquarters at Hamlet, N. C., succeeding **H. T. McManus.** Mr. Layton was born at Lilesville, N. C., on August 15, 1886. He entered railway service with the Seaboard Air Line in 1905 as a section laborer at Vass, N. C., and has been in the continuous employ of this road since that time in various capacities.

C. Larson, roadmaster on the Great Northern, in charge of the district from Watertown, S. D., to Yankton, on the Sioux City division, with headquarters at Sioux Falls, S. D., has been extended over the Second division, in place of **B. H.** Falls, S. D., to Sioux City, Ia., on the same division, with headquarters at Sioux City, Ia., succeeding **D. Sullivan,** assigned to other duties. **T. R. Patterson** has been appointed roadmaster on the Sioux City division, with headquarters at Sioux Falls, S. D., in place of Mr. Larson.

J. B. Oatman, division engineer on the Buffalo, Rochester & Pittsburgh at Du Bois, Pa., has been appointed roadmaster of the Third division, with the same headquarters, succeeding **Thomas Lynch,** assigned to other duties. The jurisdiction of **Charles Gentner,** roadmaster on the Erie division, has been extended over the Second division, in place of **B. H. Briggs,** assigned to other duties. The jurisdiction of **Anthony Salinsky,** roadmaster of the Fifth division, has been extended over the Fourth division, in place of **J. H. Cummings,** assigned to other duties, the position of roadmaster on the Second and Fourth divisions having been abolished.

John Edward Fanning, whose appointment as roadmaster on the Iowa division of the Illinois Central was announced in the September issue, was born at Buena Vista, Miss., on August 13, 1885, and was educated at the University of Mississippi, from which he graduated in 1905. Mr. Fanning entered railway service in 1905 as an instrumentman on the Gulf & Ship Island at Gulfport, Miss., and continued in the service of this company in the successive capacities of assistant engineer, supervisor of track and assistant to the chief engineer, until 1917, when he entered the service of the Illinois Central as resident engineer on construction. In 1919 Mr. Fanning left the Illinois Central to become chief engineer of the Gulf & Ship Island and the Mississippi Central, but returned to the Illinois Central following the termination of federal control as assistant engineer on construction, which position he held at the time of his recent appointment.

C. J. Gardner, recently promoted to roadmaster on the Chicago, Rock Island & Pacific, with headquarters at Liberal, Kan., was born at Cole Camp, Mo., on November 1, 1889. He entered railway service as a section laborer on the Chicago, Rock Island & Pacific in 1906 and on May 1, 1912, was promoted to section foreman, serving in this capacity in various places until March 1, 1917, when he was promoted to yard foreman. From June 20, 1917, to April 11, 1918, he served as section foreman at Henley, Mo., and on the latter date was promoted to roadmaster, with headquarters at Pleasant Hill, Mo. On August 15, 1918, he was appointed section foreman, serving in either this capacity or extra gang foreman until September 1, 1921, when he was promoted to roadmaster, as noted above.

N. V. R. Hunter, whose promotion to supervisor of track on the Pennsylvania Railroad, with headquarters at Irvona, Pa., was noted in last month's issue, was born at Philadelphia, Pa., on February 27, 1889. He graduated from Lafayette College in 1911 and entered railway service as a rodman on the Pittsburgh division of the Pennsylvania on November 1 of the same year. On May 1, 1912, he was transferred to the Conemaugh division and again on May 1, 1915, to the Philadelphia Terminal division. On May 15, 1916, he was promoted to transitman, working under the direction of the general office until October 16 of the same year when he was promoted to assistant supervisor of track at Warren, Pa., where he remained until June 1, 1917, when he was transferred to Titusville, Pa. About three months later he was furloughed, entering the military service of the United States on September 17, 1917, from which he was discharged on July 7, 1919. He then returned to the Pennsylvania as an assistant supervisor of track at Johnstown, Pa., on July 15, being subsequently transferred on May 1, 1920, to West Philadelphia, and on March 16, 1921, to Trenton, N. J., where he remained until promoted to supervisor of track at Irvona.

BRIDGES AND BUILDINGS

Charles W. McCandless has been appointed supervisor of bridges and buildings on the Southern Pacific, with headquarters at Dunsmuir, Cal., in place of Neal Frazer, who has been assigned to other duties.

F. A. Jones, track supervisor on the Boston & Albany with headquarters at Boston, Mass., has been appointed assistant supervisor of bridges and buildings with headquarters at Springfield, Mass., succeeding **H. E. Sanbourn,** transferred, as noted elsewhere in these columns.

A. J. Chesney, general foreman bridges and buildings on the Grand Trunk Railway with headquarters at Portland, Me., has been promoted to supervisor of bridges and buildings with the same headquarters. Mr. Chesney was born at Huntings Mills, Quebec, Can., on September 22, 1862, and entered railway service on November 14, 1894, as a carpenter in the bridge and building department of the Grand Trunk Railway at Gorham, N. H. Subsequent to this date he served in various capacities and various points on the Grand Trunk until April 28, 1919, when he was promoted to general foreman in the bridge and building department with headquarters at Portland, Me., where he remained until his recent promotion as noted above.

PURCHASING AND STORES

J. D. McCarthy has been appointed purchasing agent of the Minneapolis & St. Louis, with headquarters at Minneapolis, Minn., succeeding **W. E. Manchester,** resigned.

J. M. Velasco, assistant general purchasing agent of the National Railways of Mexico, with headquarters at New

York, has been appointed purchasing agent with headquarters at Mexico City. Mr. Velasco is succeeded by W. L. Wibel.

OBITUARY

William Ross, for many years a chief carpenter on the Chicago, Milwaukee & St. Paul, died on September 11 at his home at Milbank, S. D. Mr. Ross was born in Canada on October 20, 1847, and entered the service of the Chicago, Milwaukee & St. Paul in 1879 as a bridge carpenter, having previously served on the Central of Vermont. In 1881 he was promoted to pile driver foreman and in 1882 was appointed chief carpenter of the Hastings and Dakota and the James River divisions, which position he held until 1910 when he was appointed yard foreman.

F. W. Leatherbury, division engineer of the Southern division of the Gulf, Colorado & Santa Fe, with headquarters at Temple, Tex., was drowned on September 9 while inspecting a bridge during the recent flood in central Texas. Mr. Leatherbury received his education at the Virginia Polytechnic Institute, from which he graduated in 1906. In August of that year he entered the service of the Gulf, Colorado & Santa Fe as chainman, since which time he has served consecutively as rodman, transitman and division engineer, serving in the latter capacity from March 1, 1914, until the time of his death.

C. E. Powell, general bridge inspector of the Chesapeake & Ohio, with headquarters at Covington, Ky., died on August 27. He was born at Crozet, Va., on February 12, 1860, and entered the service of the Chesapeake & Ohio in 1877 as a bridge carpenter at Charlottesville, Va. In 1883 he was promoted to carpenter foreman and in 1888 was promoted to assistant supervisor of bridges and buildings at Newport News. From 1896 to 1898 Mr. Powell served as supervisor of bridges and buildings at Richmond, Va., and in the latter year was transferred to the Clifton Forge and Huntington territory. He was appointed general bridge inspector in 1913, which position he held at the time of his death.

George B. Woodworth, rail inspector of the Chicago, Milwaukee & St. Paul, whose death was announced in the September issue, was born in Mohawk, N. Y., in 1848. Mr. Woodworth studied at Lombard College and the University of Chicago in anticipation of practicing law, but shortly after graduating from the latter institution, he decided upon an engineering career and entered railway service as an axman on a surveying party on the Volga City Line, now a branch of the Dubuque division of the Chicago, Milwaukee & St. Paul. Following his connection with this road he spent some years in construction work on the Chicago, Kenton, Dubuque and Minnesota lines, subsequently leaving railroad service to become city engineer at Dubuque and still later returning to occupy the position of engineer of the Southern Minnesota during the construction period of 1879 to 1883. Upon the acquisition of this road by the Chicago, Milwaukee & St. Paul, Mr. Woodworth continued in the service of the engineering department until about 1884, when he became engaged in rail inspection work, in connection with which he was still associated as rail inspector at the time of his death.

William Henry Searles, the author of the two books, "Field Engineering" and "The Railroad Spiral," died recently at his home in Elyria, Ohio. Mr. Searles was born at Cincinnati in June, 1837, and was educated in Wesleyan University and at Rensselaer Polytechnic Institute. Following his graduation from a course in civil engineering at the latter college in 1860, Mr. Searles was employed as an assistant engineer on the Marietta and Cincinnati for two years, after which he was professor of geography and typography in Rensselaer Institute until 1864. From 1864 to 1865 he was engaged in railroad construction and location in Ohio, Michigan, Pennsylvania, Indiana and New York, serving in the successive positions during this period of chief engineer of the Mineral Range Railroad, assistant engineer of the Allegheny Bridge, Pittsburgh, Fort Wayne and Cincinnati, and as principal assistant engineer of the Allegheny Railroad. In 1870 he became chief engineer of the Indiana North and South and was appointed chief engineer of the W. S. & C. in 1872.

CONSTRUCTION NEWS

The American Railway Express Company contemplates the erection of a building at Sweetwater, Tex., to cost about $10,000.

The Atchison, Topeka & Santa Fe, which was noted in the September issue as having closed bids for additions to its power house at Albuquerque, N. M., to cost approximately $150,000, has awarded the contract for this work to E. F. Ware, El Paso, Tex.

The Atlantic Coast Line has awarded a contract to the Roberts & Schaefer Company, Chicago, for the construction of a 250-ton automatic electric coaling plant to be erected at Dothan, Ala.

The Boston & Maine has awarded a contract to the McClintic Marshall Company, Pittsburgh, for the construction of a bridge over the Winnipisseogee river, Tilton, N. H. The bridge will be about 175 ft. long and will cost approximately $17,000.

The Caddo River Lumber Company, Rosboro, Ark., will begin the construction on October 1 of a short line railroad connecting with the Missouri Pacific at Womble, Ark., and extending northward towards Oden, a distance of 16 miles. The work will cost approximately $10,000 per mile.

The Canadian National has closed bids for the construction of the sub-structure for a single track bridge over the Coffee river, 41 miles from Doucet on the St. Maurice division. This company will build a frame freight and passenger station at Barrante, Quebec, the structure to be 21 ft. by 65 ft. and to include a machinery platform 16 ft. by 29 ft.

The Central Vermont has awarded contracts to the Roberts & Schaefer Company, Chicago, for the construction of a combined gravity sanding plant, coaling plant and mechanical storage plant and for an electric cinder conveyor, both of which are to be installed at St. Albans, Vt. The coaling plant will have a capacity of 300 tons, will be equipped with a 30,000 ton drag scraper and will cost approximately $40,000.

The Chicago & Alton has awarded a contract for the construction of second track between Wann, Ill., and Brighton, about 12 miles, to Mulvill Bros., Alton, Ill.

The Chicago & North Western is accepting bids for the rebuilding of a 1,900-ft. viaduct across its yards at Proviso, Ill.

The Chicago, Burlington & Quincy has awarded a contract to the Railway Water & Coal Handling Company, Chicago, for the installation of a pipe line in connection with a reservoir being built by company forces at Valier, Ill. The Chicago Burlington & Quincy will construct a 30-ft. by 50-ft. brick machine shop at Herrin Junction, Ill., with company forces.

The Chicago Great Western contemplates the construction of a passenger station at Afton Junction, Iowa.

The Chicago, Rock Island & Pacific has awarded a contract to Joseph E. Nelson & Sons, Chicago, for the construction of an eight-stall roundhouse at Amarillo, Tex. The building will have brick walls and a timber frame and roof, and is estimated to cost about $35,000. This road will construct a new car repair shop at Trenton, Mo., with company forces. This company has awarded a contract to the T. S. Leake Construction Compuny, Chicago, for the erection of an addition to its roundhouse at Eldon, Mo., to cost about $40,000, and is contemplating the construction of an ice house at Manly, Iowa, which will cost approximately $10,000. It has awarded a contract to Roberts & Schaefer Company, Chicago, for the construction of a concrete coaling station at Morris, Ill., and also a contract to Fairbanks, Morse & Co., Chicago, for a concrete coaling station at McFarland, Kan.

The Chicago Union Station is accepting bids for the sub-structure for a viaduct at Madison street, Chicago.

The Florida East Coast will open bids about November 1 for the construction of a general office building at St. Augustine, Fla., to cost approximately $175,000. The proposed structure will be 50 ft. by 105 ft. and 4 stories in height and will be of terra cotta, marble and brick construction on a reinforced concrete frame.

The Great Northern contemplates the construction of new ore loading docks at Superior, Wis., to cost about $1,500,000, replacing wooden structures which are no longer adequate. The Great Northern has awarded a contract tc the F. W. Miller Heating Company, Chicago, for the installation of a boiler washout and refill system at Superior, Wis. The same company has awarded a contract to the National Boiler Washing Company, Chicago, for the installation of a boiler washout and refill system at Great Falls, Mont., and one at Hillyard, Wash.

The Gulf Port Terminal has been denied its application by the Interstate Commerce Commission for authority to construct an extension of its line in Baldwin County, Ala., to Mobile, a distance of approximately 25 miles.

The Illinois Central has awarded a contract for the construction of a frame engine house at Herrin, Ill., to G. A. Johnson & Son, Chicago.

The Illinois Central has awarded a contract to the A. Lund Construction Company, Chicago, for the enlarging of the waiting room at the Randolph street suburban station, Chicago, to cost about $20,000.

The Interstate Company has awarded a contract to the Brooks-Callaway Company, Atlanta, Ga., for the construction of three tunnels on its Guest river extension. These tunnels will be, respectively, 600 ft., 550 ft. and 350 ft. in length through hard sandstone, slate and shale. It is anticipated that two of the tunnels will require concrete linings.

The Louisiana & Arkansas is contemplating the erection of a one-story brick and reinforced concrete locomotive shop at Stamps, Ark., to cost about $150,000.

The Louisiana & Pacific has applied to the Interstate Commerce Commission for authority to abandon a line in Beauregard County, La.

The Missouri, Kansas & Texas has concluded a contract with the William Graver Tank Works, Chicago, for the supplying of three 55,000-bbl. steel oil storage tanks, four 1,000-gal. steel elevated tanks on 24-ft. steel sub-structures and four 20,000-gal. horizontal tanks to be installed on a 20-ft. substructure. The Missouri, Kansas & Texas has awarded a contract to the National Boiler Washing Company, Chicago, for unloading and delivery facilities, pumps, oil collumns, pipe lines, etc., for use with the oil tanks ordered from the Graver Corporation.

The Missouri Pacific has awarded a contract to Joseph E. Nelson & Sons, Chicago, for the construction of five car repair sheds. These sheds will be of frame construction, 40 ft. wide by 240 ft. long, and will be built at Crane, Mo., Poplar Bluff, Sedalia, Jefferson City and Nevada. The total cost of this work is estimated at about $55,000.

The New York Central has awarded a contract for the construction of a 30-stall roundhouse and auxiliary buildings at Solvay, N. Y., to the W. M. Ballard Company, Syracuse, N. Y. The same company has been awarded a contract for the construction of a 1,000-ton coaling station exclusive of machinery at Solvay. The Walsh Construction Company, Syracuse, N. Y., has been awarded a contract for the construction of a 400-ton coaling station at Waynesport, N. Y. The Link Belt Company has been awarded a contract for the machinery of both of these coaling stations.

The Southern Pacific has applied to the Nevada State Commission for authority to abandon a line extending about eight miles from Tulasco to Metropolis in Elko County, Nev., owing to the fact that this road has been operated at a loss and traverses a section from which nearly all of the original settlers have departed.

The Texas Pacific has revised its plans for the construction of a new passenger station at Ranger, Tex., and has issued another call for bids to be closed on September 15.

The Tonopah & Goldfield has applied to the Interstate Commerce Commission for authority to construct an extension 18½ miles long from a point near Coaldale Station in Nevada, into a new oil field.

The Toledo, St. Louis & Western has awarded a contract to the Ogle Construction Company, Chicago, for the construction of a 300-ton steel coaling station at Charleston, Ill.

The Western Maryland is accepting bids for the construction of additions to its grain elevator and facilities at Port Covington, Baltimore, Md., to cost approximately $1,000,000. The additions will be of reinforced concrete construction and will provide storage space for 1,500,000 bushels of grain in addition to the present facilities.

The Wichita Northwestern has applied to the Interstate Commerce Commission for authority to build 14 miles of railroad from Vaughn, Kan., to La Crosse, for the purpose of transporting traffic which will consist chiefly of agricultural, forest products and coal.

EQUIPMENT AND SUPPLIES

The Canadian Pacific has ordered 25,000 tons of rail from the Algoma Steel Corporation.

The Chicago, Burlington & Quincy is accepting bids for structural steel to be used in building a new freight house at Chicago.

The Chicago, Burlington & Quincy is accepting bids for structural steel to be used in building a new freight house at Chicago.

The Cleveland, Cincinnati, Chicago & St. Louis has placed orders for 900 tons of steel, of which 200 tons will be used for bridge renewals and about 700 tons for track elevation work at Indianapolis, Ind.

The Evansville, Indianapolis & Terre Haute has ordered from the Mt. Vernon Bridge Company, Mt. Vernon, Ill., 200 tons of steel for its Eel river bridge in Indiana.

The Meiki Railway, Osaka, Japan, is inquiring through Mitsui & Company, New York, for 1,000 tons of 60-lb. rail; Mitsui & Company are also inquiring for about 1,000 tons additional of 30-lb. and 60-lb. rail for export to Japan.

Mitsui & Co., New York, are inquiring for 60-lb. A. S. C. E. rail and accessories for 25 miles of track for the Neiki Electric Railway of Japan, which railway also contemplates the purchase of rail for an additional 29 miles of road at a later date.

The New York Central closed bids on September 29 for its present requirements on rolled steel gears, fence wire, track bolts, bottom plates for crossing frogs and manganese frogs.

The Pennsylvania has awarded a contract to the Eppinger & Russell Company, Jacksonville, Fla., to creosote 300,000 cross ties.

The Mississippi Central has obtained authority to abandon a branch line extending 12 miles from Hattiesburg, Miss.

The Central New England has obtained authority from the Interstate Commerce Commission to abandon a line about two miles long in Hampden county, Mass.

The Middle Tennessee, a road extending 45 miles from Franklin, Tenn., to Mt. Pleasant, has been sold to John H. Carpenter of Nashville, Tenn., for $300,000.

According to the records of the Illinois Central there are four section foremen on its Springfield division who have been in the service of the road from 34 to 49 years, during which no accidents have befallen either themselves or the men working under their direction. These men are George F. Shimp, at Patoka, Ill., whose record of service is 49 years; Thomas Hughes of Champaign, Ill., with a service of 41 years; Martin Hughes at Lincoln, Ill., with a service of 41 years, and John M. Pyatt at Erie, Ill., with 34 years.

SUPPLY TRADE NEWS

GENERAL

The Western Electric Company, New York, has re-zoned its sales territory, and a new district, called the Atlantic district, has been established, of which **R. W. Van Valkenburgh** has been appointed manager, with headquarters at Philadelphia, Pa. The new district includes the area covered by the Philadelphia and Pittsburgh houses, which formerly was part of the Western district.

PERSONAL

Henry Elliott, Jr., president of the **Elliot Frog & Switch Company,** East St. Louis, Ill., died at his home at St. Louis, Mo., on September 9, from the effects of a cerebral hemorrhage.

Daniel Sellinger for over twenty years in charge of rail inspection for Robert W. Hunt & Co., at the south works of the Illinois Steel Company, Chicago, died on August 24, at the age of 63.

F. A. Poor, Patrick H. Joyce and **Edward N. Roth** have been elected members of the board of directors of Mudge & Company, Chicago. There has been no change in the control of the company.

Henry S. Lebarge, formerly Chicago representative of the Handlan-Buck Manufacturing Company, has been appointed manager of the railroad department of the H. Channon Company for Chicago territory.

H. S. Durant has been appointed sales agent, and **M. W. Floto** assistant sales agent, at the Detroit office of the American Steel & Wire Company, Chicago, to succeed M. Whaling and T. J. Usher, Jr., resigned.

Thomas H. Greenwood has been appointed factory manager of the McDougall-Butler Co., Inc., Buffalo, N. Y., makers of paint and varnish for railway uses. This company has appointed the Ehrlich Paint Company, Cincinnati, Ohio, as its representative in the Cincinnati district.

W. R. Pflasterer, railway sales engineer of the National Carbon Company in the Chicago territory, has resigned, to become sales manager of the newly organized Direct Sales Company, with headquarters in Chicago. This company will act as a manufacturers' representative, handling railroad accounts in the Chicago district.

F. V. Shannon, vice-president and secretary of the Massey Concrete Products Corporation, Chicago, has resigned. **G. H. Redding** has been elected secretary in place of Mr. Shannon, while the position of vice-president remains vacant for the present. **David A. Hultgren** has been appointed resident manager at Chicago.

Robert D. Black, assistant sales manager of the Black & Decker Manufacturing Company, has been appointed manager of the Philadelphia branch office, with headquarters at 318 North Broad street. He succeeds W. C. Allen, who has been appointed special factory representative, with headquarters at the Cleveland branch office, 6225 Carnegie avenue.

T. N. Gilmore, for the past 16 years associated with Westinghouse, Church, Kerr & Company, engineers and contractors, has opened offices as a consulting engineer at 136 Liberty street, New York. Mr. Gilmore was in charge of railroad shop and engine terminal work for Westinghouse, Church, Kerr & Company and was for several years a director and vice-president and chief engineer of the company, in charge of all engineering and construction. He received his early training in steam railroad work. Prior to the World's Fair at St. Louis in 1904, he was with the Terminal Railroad Association of St. Louis, in charge of the mechanical and car departments. In addition he also planned the power houses, locomotive shops and engine terminal facilities constructed to handle the traffic for the fair.

TRADE PUBLICATIONS

Locomotive Terminals.—A 33-page booklet entitled "Locomotive Terminals" has recently been prepared by Dwight P. Robinson & Company, which illustrates and describes several representative terminal problems which the company has worked out for railroads in various parts of the country. Supplementing the interesting treatment given to the projects worked out for the nine railroads in the main portion of the book is a list of work done for other representative roads.

Locomotive Cranes.—A booklet entitled "Man-Power Multiplied" has been issued recently by the Brown Hoisting Machinery Company, Cleveland, Ohio, on the company's Brownhoist No. 2 locomotive cranes. The first pages of the booklet are devoted to illustrations showing some of the many purposes for which these cranes are being used, the other pages describing in detail the construction and mechanism of the cranes, including a table of capacities, weights, wheel loads and clearances.

Shallow Pit Coaling Plants.—A new 28-page pamphlet issued by the Roberts & Schaefer Company, Chicago, as bulletin No. 43, contains a large number of photographs and descriptions of coaling stations recently erected by that company for various railroads in the United States. Special reference is given to the RandS shallow pit type of station, which is adapted to locations where the presence of water or other adverse foundation conditions tend to discourage the construction of a deep pit.

Mill Data.—The National Lumber Manufacturers' Association, Chicago, has issued additional data on mill construction. The subjects treated in these sheets deal with basement floors, roof and roof coverings and include a set of floor beam charts to facilitate the determination of the most economical system of floor construction to carry a given load. Another subject presented is a progress report of tests made by the Forest Products Laboratory, Madison, Wis., in co-operation with the association on built-up beams under various loads in comparison with solid timbers.

Coaling Stations.—A small bulletin has recently been issued by the Howlett Construction Company, Moline, Ill., in which is described a small locomotive coaling station of the balanced bucket type which it has recently added to its line of equipment for railways. The pamphlet is devoted chiefly to the illustrating by diagram and photograph of installations of the kind made for the Great Northern at Bellingham and Rockport, Wash., and for the Chicago, Memphis & Gulf railroad. The pamphlet contains illustrated matter on the company's largegr coaling stations and a list of the work which was done in 1920.

Heaters.—The B. F. Sturtevant Company, Hyde Park, Boston, Mass., has recently issued catalog No. 230 for the use of railway officers interested in heaters and heating. The first part of the book describes the construction, operation and mechanical details of Sturtevant heaters and is intended for those who are not buying this class of apparatus regularly. The latter part, which gives performance tables, diagrams and dimensions, is for the benefit of engineers, architects and steamfitters, to enable them to choose the heater necessary for any given building. Diagrams showing proper methods of making steam connections and the space occupied by heaters are also included.

Lackawanna Steel Sheet Piling.—The Lackawanna Steel Company, Lackawanna, N. Y., has issued bulletin No. 109, 172 pages, illustrated, which describes the various types of sheet piling manufactured by this company and their application to construction work. The bulletin in reality is a text book on the application of sheet steel piling in construction work, wherein water, earth or other materials are to be retained as in cofferdams, open caissons, foundations of bridges, etc. The application of sheet piling to all of these various classes of work is not only described in the written matter, but is also illustrated by a large number of photographs showing the actual installations. Other photographs and drawings show all of the various types manufactured by this company as well as the different combinations for which they are adapted. Other sections of the bulletin describe and illustrate various methods for handling the piling.

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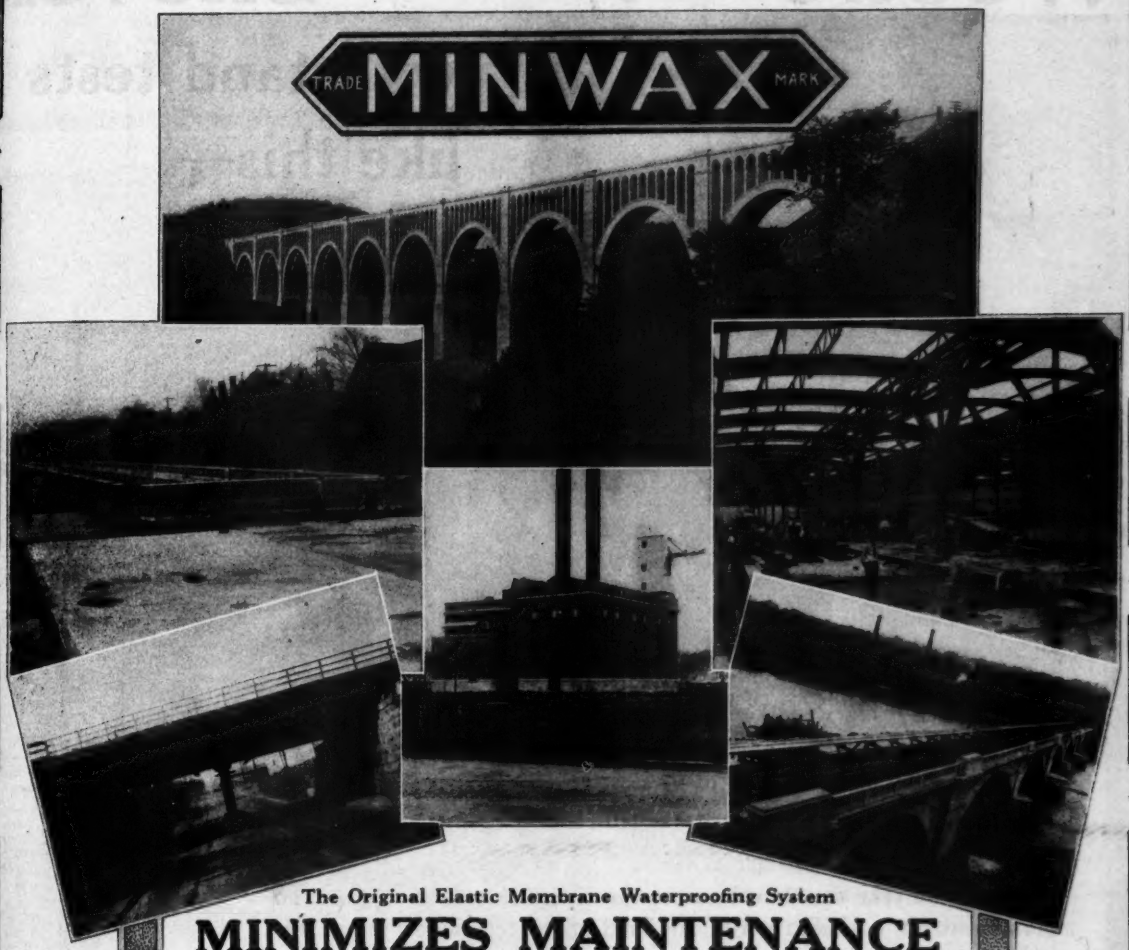

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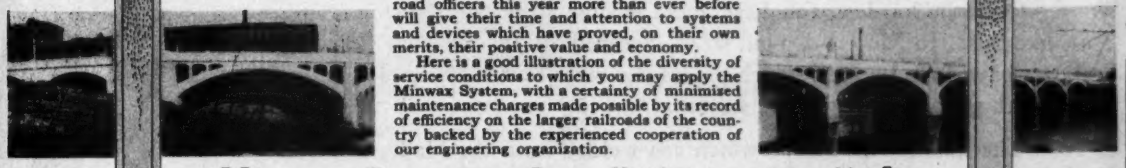
The Minwax Company appreciates that railroad officers this year more than ever before will give their time and attention to systems and devices which have proved, on their own merits, their positive value and economy.

Here is a good illustration of the diversity of service conditions to which you may apply the Minwax System, with a certainty of minimized maintenance charges made possible by its record of efficiency on the larger railroads of the country backed by the experienced cooperation of our engineering organization.



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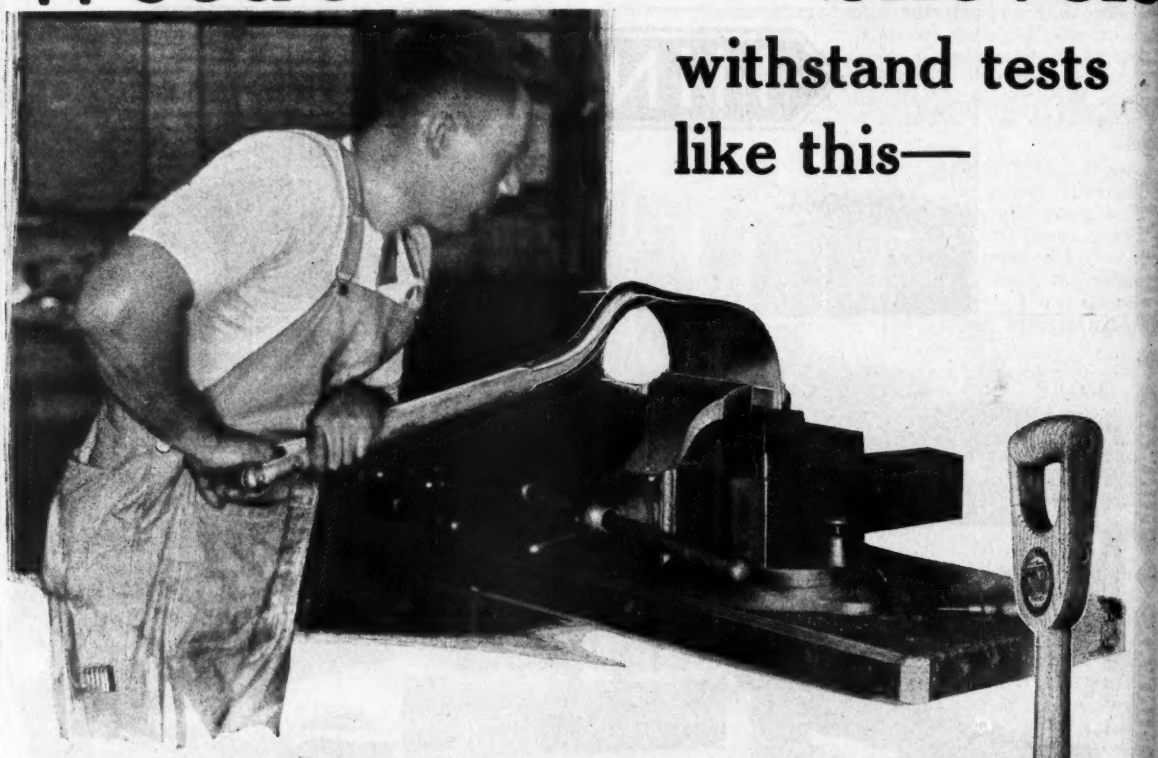
Wood's Mo-*lyb*-den-um Shovels

withstand tests like this—



PLACE the edge of a Wood's Mo-*lyb*-den-um Steel Shovel in a vise. Bend it 90 degrees forward as in the illustration. Then bend it backward the same distance.

When you take the shovel out of the vise it shows no fracture, no permanent set, no indication of any kind of the terrific test it has just gone through.

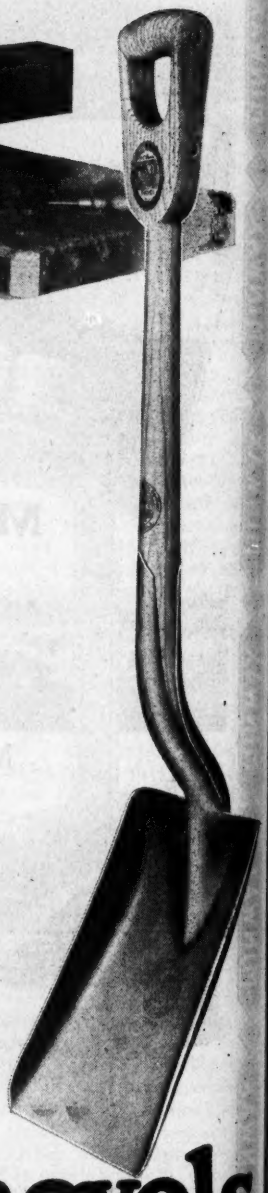
Only the hardest, toughest, most flexible steel can withstand a test like this. In Mo-*lyb*-den-um steel—treated by our exclusive method—we have found a steel which passes the most severe tests. It's a steel which gives you long, hard service.

The handle, the straps which are welded onto the blade, and even the rivets are designed and built with the same high standard of material and workmanship. The shovel illustrated is designed especially for railroad maintenance use. Buy one or a thousand dozen of them—they're all the same.

Write for our folder on the railroad maintenance shovel.

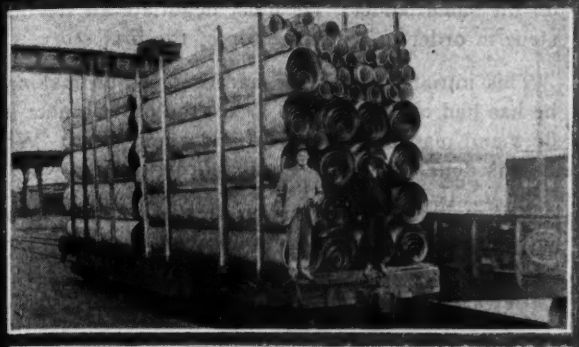
WOOD SHOVEL AND TOOL COMPANY
Piqua, Ohio U. S. A.

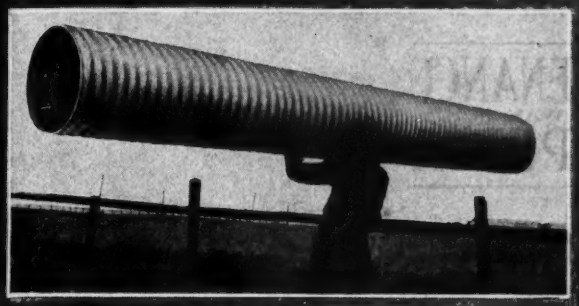
This special railway maintenance shovel is made of the same high-grade Mo-lyb-den-um steel that is used in the foundry shovel illustrated in the test above.

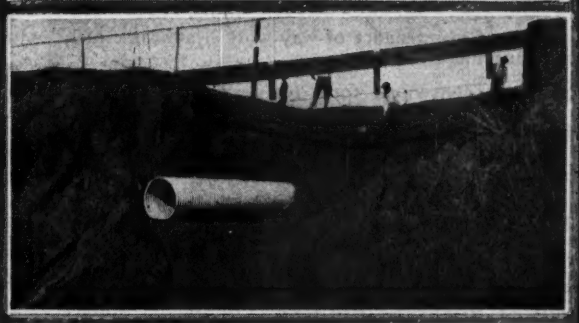


Wood's Mo-lyb-den-um Shovels
The American Super Steel

Armco Culverts







Economy of Transportation — Some conception of the economy of transporting Armco Culverts may be gained from the photograph to the left which illustrates a method of loading. This flat car contains 261 Armco Culverts ranging in diameter from 8 to 36 inches and having a total length of 4,470 feet. The weight, including 75 connecting bands, is only 60,495 pounds.

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Easily Installed — No heavy, cumbersome and costly machinery is required for the installation of Armco Culverts. In numerous instances it is only necessary to dig a trench and roll the culvert in place. At times when it is not permissible to dig a trench across railroads or important highways, a tunnel may be dug under the roadbed and the culvert inserted.

Permanence Assured — The chemical purity homogeneous texture and heavy galvanizing of Armco Ingot Iron, from which Armco Culverts are made, enables them to resist rust and the deteriorating action of soil or climate. The installation shown here was made under a dirt road in 1911—paved over as a permanent installation in 1913—and in perfect condition today.

ARMCO Ingot Iron

There is a manufacturer in nearly every state, and in Canada, making genuine rust-resisting ARMCO CULVERTS and other products of Armco Ingot Iron such as flumes, siphons, tanks, road signs, roofing, etc. Write for full information and nearest shipping point on products in which you are interested.

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The man who is ambitious to become a real railroad man has a lot of chances.

The maintenance of way department offers as good a chance as any.

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First of all, he has got to become a good all-around maintenance of way man. That is his department and his knowledge of one branch of it has already put one foot on the ladder. But there are several other rungs on the same ladder. He must negotiate all the other steps in order to reach the top of the first story.

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For making the first ladder an easier climb, involving as it does a working knowledge of every branch of the maintenance of way department, there is no better assistance than that afforded by the

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Edited by E. T. Howson, Western Editor Railway Age and Editor Railway Maintenance Engineer; E. R. Lewis, formerly Chief Engineer and Assistant to General Manager, Duluth, South Shore & Atlantic Railway; and (Signal Section) K. E. Kellenberger, Editor Railway Signal Engineer.

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Has a higher boiling point—three times the permanent properties of any competing oil—no impurities or adulterants to bleed out—is the highest quality, most economical oil to buy. Use it in your treating plants, and specify its usage in your tie contracts.

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The "Road Boss" helps your men do a bigger day's work with greater ease.

For reliability, economy and efficiency the four-cycle engine takes the lead.

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This engine weighs but 205 pounds fully equipped. A car can be easily handled by one man.

It has a speed of from 3 to 25 miles per hour and will pull a heavy load at slow speed or get over the road quickly on a hurry call.

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Equipped with a "Road Boss" your section car, as a piece of reliable, economical, effective machinery, comes into the same class as automobiles, tractors, trucks and airplanes, all of which are equipped with four-cycle engines.

Our prices include complete equipment ready to mount. Ask us about them.

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RU-BER-OID ROOFING

The original asphalt ready-to-lay roofing. Made from the same formula for over 28 years.

Smooth surfaced, fine talc dusted finish. Special large-headed sherardized (zinc impregnated) nails and Ru-ber-ine Cement in each roll.

Ru-ber-oid Roofing wears longer than ordinary prepared roofings, therefore, most economical.

RU-BER-OID UNIT-SHINGLES

Green or red, slate surfaced, 8"x15", 5 inch exposure.

Ru-ber-oid Giant and Hercules Building Papers

Other Railroad Products

Ruberoid Burlap Plastic Roofing
Ruberoid Cement-Waterproofing
Ruberoid Oil Paint
S P C Graphite Paints
Ruberoid Cement Floor Filler and Enamels
P & B Acid Resisting Paints
P & B Insulating Compounds
P & B Insulating Tape

THE RUBEROID CO.

Formerly The Standard Paint Company

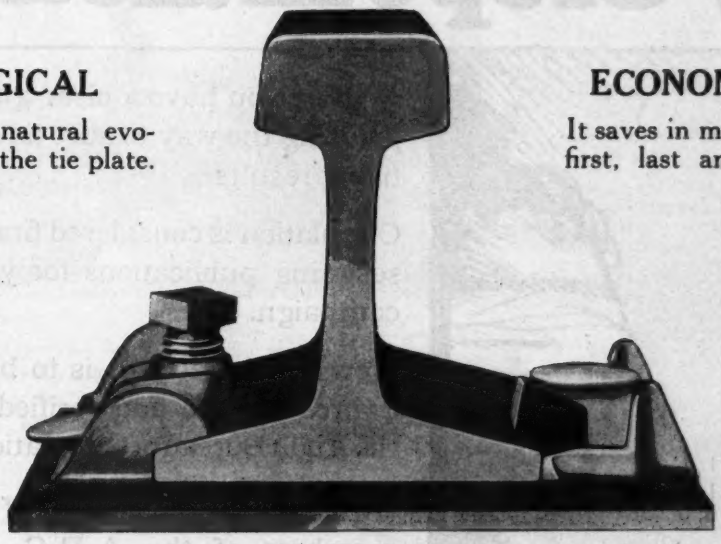
95 Madison Avenue, New York

CHICAGO **BOSTON**

RAIL ANCHOR TIE PLATE WITH KEY

SENSIBLE
It holds both ways

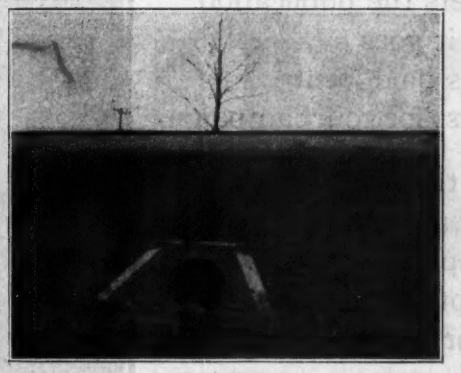
LOGICAL
It is the natural evolution of the tie plate.



ECONOMICAL
It saves in maintenance first, last and always.

When you try to hold rail from creeping one way with an anti-creeper, you must assume the rail contracts and expands the other way.

CHICAGO MALLEABLE CASTINGS COMPANY, West Pullman, Chicago, Ill.



Why you should use
NATIONAL LOCK JOINT PIPE

It is made of pure Alabama pig iron and will not rust.

It is made in short lengths (3, 4 and 5 ft.) to permit of easy handling. Any section gang can install it without accessory of any kind.

Installations can be made without interruption to traffic. No piles to drive. No fills to remove. No tunneling required.

National Lock Joint Pipe locks effectively, preventing separation and assuring alignment. Low cost is made possible by economy of metal per foot.

Recent price reductions have placed "National" pipe at a figure which is very close to pre-war level.

WHAT ARE YOUR REQUIREMENTS?

AMERICAN CASTING CO.
Birmingham, Ala.

Chicago Office - - - - - - Peoples Gas Bldg.
New England Representative
Fred A. Houdlette & Son - - - - Boston, Mass.
St. Louis Representative
H. P. Webb - - - - - - - Wainwright Bldg.
St. Paul Office - Contractors Supply Equipment Co.

Headley Number 1

CROSSINGS
and
STATION PLATFORMS

Write for Particulars and Booklets

HEADLEY GOOD ROADS CO.
Franklin Trust Bldg., Philadelphia, Pa.

BRANCH OFFICES:
St. Louis, 1946 Railway Exchange Bldg.
Chicago, 179 West Washington Street
West Medford, Mass., 37 Prescott Street
Indianapolis, Ind., 911 Hume-Mansour Bldg.

Why Grope in the Light?

—when you have a clear guide pointing the way to sure advertising results?

Circulation is considered first in selecting publications for your campaign.

How much better it is to have figures audited and verified by the Audit Bureau of Circulations.

Twice a year the records of the members of the A. B. C. are checked. The reports then issued give in detail information from which you can tell—

Who gets the publication
Where it goes
What is paid for it
Its fitness for your campaign

Work in the light of Audit Bureau Reports, and your advertising appropriation will go farther. Your message will go to the *right* readers.

The Railway Maintenance Engineer, published by the Simmons-Boardman Publishing Company, is a member of the A. B. C. and welcomes comparison of circulation facts. Publishers' Statements or Audit Reports will be gladly supplied upon request.

Audit Bureau of Circulations
202 South State Street Chicago • 347 Fifth Avenue New York

AMERICAN SPEED-MAKERS

American Combined Rip and Cut-off Saw, with Gasolene engine, cutting Bridge lumber, near Atlantic City, N. J.

"We had over 100,000 feet of 4" oak plank to square and could not have found a more suitable rig. The way it cut that oak was wonderful. I was certainly much pleased."

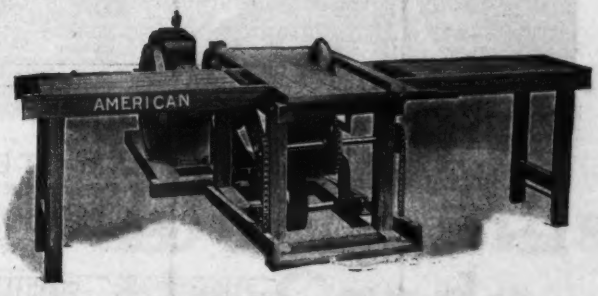
J. A. Armstrong, Supt.
J. H. Terry & Co.
Philadelphia, Pa.

There is an AMERICAN machine you need for Resawing dimension timbers; Cutting off timbers; Making concrete forms; all kinds of mill work on the job.

Also woodworking machinery for the shop. Catalog for the asking.

The Western Maryland R. R. recently tried taking the machine to the lumber instead of taking lumber into the mill four hundred feet away. The work was cutting up 5000 ft. of 2⅜" x 6" plank.

Cost with portable saw.....	$ 9.68
Cost taking to mill	20.40
Portable saw saved.....	53%



Combined Rip and Cut-off Saw

American Saw Mill Machinery Co.
140 Main Street, Hackettstown, N. J.

TANKS For RAILWAY SERVICE

The Value of Comparison.

Consider the mountain and the hillock; the Zeppelin and the toy balloon; the train and the stage coach; Diamond Dick and Mark Twain—wherever you look, the higher always gains by comparison with the lower.

It is in the opportunity to **compare** that constitutes the chief value of railway conventions.

DES MOINES Railway Service Tanks are standardized in design, material and detail. Compare them.

If special conditions, uses or other circumstances require special design or special details for which the DES MOINES standard tank is not entirely adequate, in this case consult the DES MOINES engineers. A corps of designing and consulting engineers are maintained at each of our three plants, and are always ready to confer with Railway Maintenance men. Such conference entails no obligation whatever.

Write for Special Railroad Catalogue No. 79.

DES MOINES
For Railway Service

Pittsburgh-Des Moines Steel Company
942 CURRY BUILDING PITTSBURGH, PA.

NEW YORK, 243 Hudson Terminal
CHICAGO, 1242 1st Nat'l Bank Bldg.
DETROIT, 1142 Book Building
WASHINGTON, 942 Munsey Bldg.
SAN FRANCISCO, 342 Rialto Bldg.
DALLAS, 1242 Praetorian Bldg.

DES MOINES PLANT AND OFFICE:
942 Tuttle Street, Des Moines, Iowa

CANADIAN PLANT and OFFICES: 242 Inshes Ave., Chatham, Ont.
Canadian Des Moines Steel Co., Ltd. 79 St. James St., Montreal, Que.

Bethlehem One-Piece Guard Rail

Bethlehem One-Piece Guard Rails in Large Eastern Railroad Terminal

Bethlehem One-Piece Guard Rails when spiked in position are positively held and cannot work loose—eliminating all loose pieces such as clamps, plates, braces, bolts, etc. Integral tie plates extending under the main rail receive the weight of the train, which helps hold the guard rail in place. The foot guards at the ends are part of the guard rail itself, and are therefore always in position.

Bethlehem One-Piece Guard Rail has a unique self-cleaning feature; the arched construction between the ties provides large openings through which the snow, ice and dirt works out.

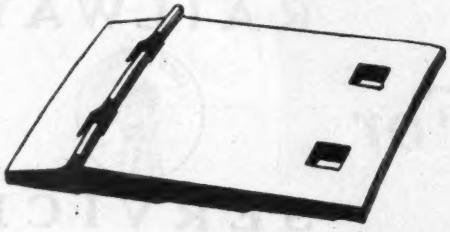
BETHLEHEM STEEL COMPANY

General Offices: BETHLEHEM, PA.

Sales Offices:

New York, Boston, Philadelphia, Baltimore, Washington, Atlanta, Pittsburgh, Cleveland, Detroit, Chicago, St. Louis, San Francisco

SOLE EXPORTER OF OUR COMMERCIAL PRODUCTS CONSTECO CONSOLIDATED STEEL CORPORATION 25 BROADWAY, NEW YORK, U.S.A.



The Lundie Tie Plate

The Lundie Tie Plate is widely acknowledged by railroad men having such plates in track, as promoting decided economy in rail wear, in holding track to gauge and in giving easy riding track. It will far more than pay for itself in reduction of Operating Expenses.

The features of the plate are—a sloping seat inclining the rail, so reducing abrasion and internal stresses in the rail to a minimum—a true camber promoting easy riding—and a bottom, as shown in the cut, so seating itself on the tie that the track is held firmly to gauge without injury to the tie.

The combination of these features, or their mechanical equivalent, is covered by Letters Patent, supported by other Patents covering certain individual features of the plate. Railroad companies pay no royalties on its authorized use.

The Lundie Engineering Corporation

920 Broadway, NEW YORK

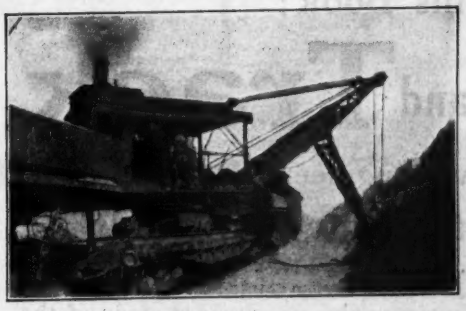
Chicago Office, 30 North La Salle Street

The Days of Prospecting Are Over

No longer do the prospector and the pack mule roam the hills in search of gold—wise men know where the gold lies and steady, concentrated effort brings it to the markets of the world.

Wise men these days are not prospecting for business and wise buyers of railroad materials are watching the steady, consistent effort of the advertisers in the

Railway Maintenance Engineer



It is easy to make claims —but the record of sixteen years speaks louder than words.

The first "AMERICAN" Railroad Ditcher did so much more than we claimed it would that it proved to be one of the best salesmen that we ever sent out. And the more than 500 "AMERICANS" built and sold since then have done almost as well, for the "AMERICAN" Railroad Ditcher sells on its record.

Many "AMERICANS" are sold on records made ten or twelve years ago when labor costs were lower. Today the "AMERICAN" Railroad Ditcher is a vastly better machine than it was ten years ago, and its field of usefulness has become much broader.

"AMERICANS" are sold on performance—not rosy dreams, or price concessions. A machine that may save its cost in a few weeks is dirt cheap. And a machine with the "AMERICAN'S" wonderful performance record does not need to weave rosy dreams into its selling propaganda.

We make no claims for the "AMERICAN" Railroad Ditcher that the machine has not already made good. Many of our strongest selling arguments are merely quotations from letters written by pleased railroad officials.

We want your inquiries. An "AMERICAN" representative can reach you in twenty-four hours.

"Give me where I may stand and I will move the world"

American Hoist & Derrick Co.
Saint Paul Minnesota

Builders of "AMERICAN"

Hoisting Engines — Locomotive Cranes — Sugar Cane Machinery
Electric Hoists — Railroad Ditchers — Marine Deck Machinery and Tackle
Derricks — Logging Equipment — The Genuine "CROSBY" Wire Rope Clip

New York Chicago Pittsburgh Seattle New Orleans Detroit

AMERICAN HOIST & DERRICK CO.

performance on the job COUNTS

5200 Pounds Up Grade

This Fairmont engine is owned by Elie Dandelin operating on the Central Vermont R. R. The lumber weighs 4100 pounds; besides the lumber, tools and men there are other materials weighing 1100 pounds.

Mr. Dandelin advises that he has used his Fairmont steadily for eighteen months—traveling 5240 miles without spending one cent for repairs.

Extra power, long life, low up-keep and economy have proven the Fairmont a wonderful help towards maintenance, efficiency and economy on nearly every railway system in America.

We have some valuable maintenance information for you. Send for it.

Fairmont Gas Engine and Railway Motor Car Co.

Dept. C4 Fairmont, Minnesota

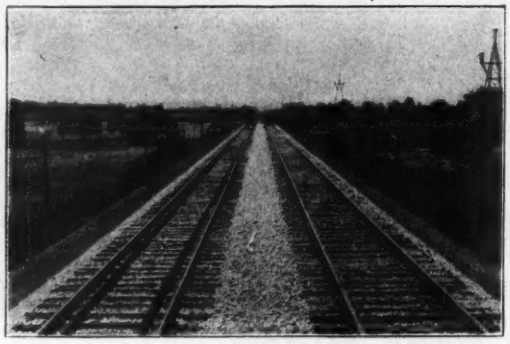
Fairmont Ball Bearing Motors

Have You Seen This Book?

Roadway and Track

By W. F. RENCH, Civil Engineer

If Not—It Will Cost You *Nothing* to Examine It



Labor-Saving Methods

Labor-saving devices and methods are receiving increased attention in maintenance of way work on all roads to-day. The employment of machines where possible is desirable also to avoid the many minor accidents. The broad provisions of workmen's compensation laws make it imperative that the roads shall strive earnestly to reduce the number and seriousness of such accidents.

Use of Tools

The correct choice, care and use of small tools are also important, not only in increasing efficiency, but in promoting the safety with which such work shall be done. The proper selection and use of tools will result in a marked saving in the expenditure for new tools and an increase in the output of the section forces.

Program of Work

The organization of the working forces for the repair of either roadway or track is an important element for progress along economic lines and deserves careful attention. Track work, such as ballasting and rail laying, is developed to as nearly a perfect system as possible. A study of the individual case will determine its proper conduct, but many points are given which will aid in reaching a solution. The book includes a suggested program for M. W. & S. work. A careful survey of this program will convey helpful suggestions, and so, indeed, will every other chapter in this necessary work.

Simmons-Boardman Publishing Company

Book Service Dept.

Woolworth Bldg., New York, N.Y.

"The House of Transportation"

A QUARTER of a century's practical experience plus an extended study of the subjects treated are summed up for you in Roadway and Track. Here is a partial list of chapter headings.

The Right of Way
Drainage of Roadbed and Track
Vegetation for Banks
Labor Saving Devices and Methods in Roadway Work
Economics of Roadway
A Program of Maintenance of Way and Track Work
Tools and Their Uses
The Track Obstruction
Labor-Saving Devices and Methods in Track Work
Practice in Renewal of Rail
Maintenance of Main Tracks
Economics of Track Labor
Maintenance Problems and Methods Used
Special Duties in the Maintenance of Way Department

These headings serve to show how thoroughly the subjects of railway and track are covered.

Some forty plates are included which were selected with the one purpose of illustrating the various processes described in the text. Many of them are views taken during the actual course of those special maintenance of way improvements with which the author has been connected as supervisory officer.

Use the Coupon

Let us send you Roadway and Track on ten days' approval. No red tape, just fill in, clip and mail the coupon to us and we will send you a copy by return mail for examination. Look it over carefully and if you decide to keep it, mail us $3.00, otherwise return the book to us.

250 Pages. 40 Illustrations.
Size 6 x 9 inches. $3.00.

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Please send me on approval a copy of ROADWAY AND TRACK by W. F. Rench, C. E., priced at $3.00. I will remit $3.00 in payment or return the book to you within ten days after its receipt.

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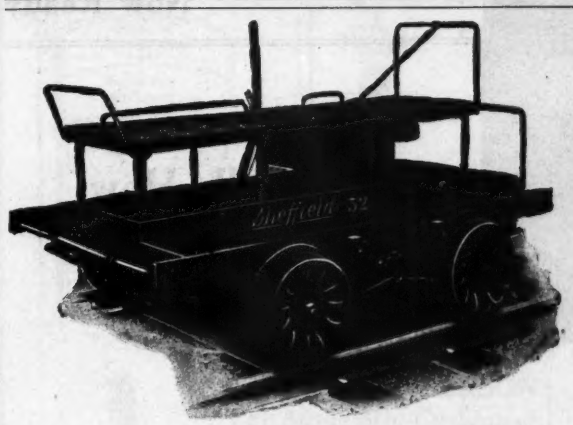


Over Seven Thousand Fairbanks-Morse Sheffield 32 Motor Cars in Service

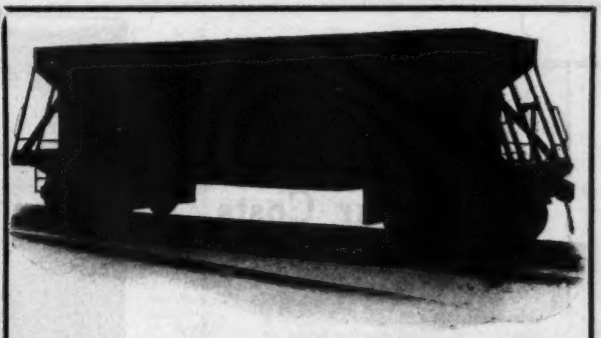
The Sheffield "32" Motor Car was placed on the market twelve years ago. Today there are over seven thousand working on sections on all of the leading railroads of the United States. Hundreds of the first cars built are still in service. More Sheffield "32" cars are in use than any other single model of motor car ever manufactured.

This record proves the correct design and quality construction of this general service section car. No material changes have been found necessary during these twelve years—it led the Motor Car field then—it leads now. The 32 motor car makes few trips to the repair shop. It is sturdy, efficient and dependable—always ready to work.

The engine is a horizontal, 2-cylinder, 2-cycle, air-cooled unit, which drives the wheels through the rear axle, serving as the crankshaft. No gears, chains, valves or cams.

Section foremen with Sheffield "32" cars do more work in less time with fewer men.

Fairbanks, Morse & Co.
MANUFACTURERS CHICAGO
Oil Engines · Pumps · Electric Motors and Generators · Fairbanks Scales · Railway Appliances · Farm Power Machinery



Better Car Protection

Judge a paint by how long it will last and not by the "price per gallon."

DIXON'S Silica-Graphite Paint

will give better paint protection on steel cars because of its pigment, flake silica-graphite. It does not combine chemically with the linseed oil vehicle and can thus devote all of its resisting powers against exterior influences of corrosion. Write for Booklet 187-B.

JOSEPH DIXON CRUCIBLE COMPANY
Jersey City New Jersey
Established 1827

DeVilbiss Spray-painting System

Painting Equipment for Real Service

GETTING MORE AND BETTER WORK DONE with fewer workmen, or in less time, is accomplished with DeVilbiss spray-painting portable equipment.

This REAL SERVICE is to be had on bridge or structure painting along the right of way as on any other painting of the maintenance department.

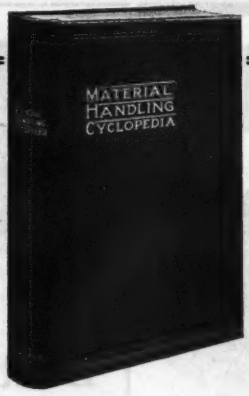
Let us place before you operation and equipment facts of the DeVilbiss outfit—they point the way to a solution of most painting problems.

The DeVilbiss Mfg. Co.

3682 Detroit Ave.

Toledo, Ohio

Now Ready



Cut Your Costs **This Tells How**

If you are interested in moving materials

Material Handling Cyclopedia

was written for you

TO you maintenance engineers and executives who have to do with the use of ***transferation*** *machinery, the 1921 MATERIAL HANDLING CYCLOPEDIA will render a signal service. All sorts of devices used in construction and maintenance work are thoroughly covered in each section of the book. Cranes, Hoists, Winches, Derricks, Excavators, Buckets, Steam Shovels, Scoops, Magnets, Car Loading and Unloading Equipment, Tiering Machines, Tractors and Trailers. These are just a few of the subjects treated in this book.*

A Century and a Half of Experience

THE 1921 MATERIAL HANDLING CYCLOPEDIA contains a wealth of practical information to help you with every one of your material handling problems. And this information has been written and edited by men who know the field; who are specialists in the study of ***efficient handling methods.*** *Their work, as executives, in dealing with transferation machinery application totals a period of 151 years. The best methods developed during their combined experiences are clearly set forth in Material Handling CYCLOPEDIA. Clip and mail the coupon now.*

Definition Section—150 pages

Gives terse, clear-cut definitions of the principal terms used in connection with material handling methods and equipment and brief descriptions of the mechanism of the various devices.

Technical Section—550 pages

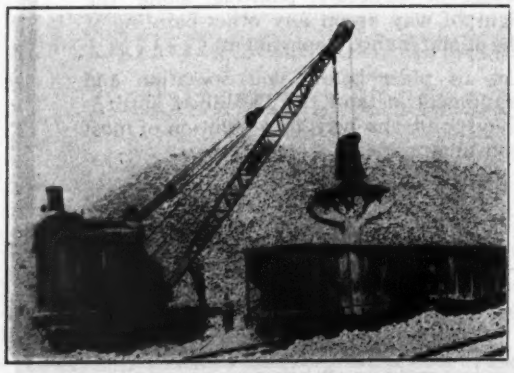
Treats of the types of material handling machines, under main classified headings. The structural design of each machine is described in detail and its uses comprehensively explained. Transferation principles are discussed at length, showing the advantages of the different devices for certain lines of work. Over 1500 carefully chosen photographs, together with hundreds of line drawings, charts, curves, etc., render the text easily and readily understood.

Catalog Section—150 pages

Enlarges and completes the other two sections. Leading manufacturers illustrate and describe their own products and point out particular advantages of these devices for the various branches of industrial service. The products represented are also grouped according to the nature of service they perform. These 150 pages of live cost data prove indispensable to the user when buying new equipment.

Other Important Features

All related data in each of the three sections is cross referenced in such a way that the user can find any information he needs at a moment's notice. For ready reference he has a Directory of Products, a Trade Name Index, and an Alphabetical Index of Manufacturers.



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Name.....

Address.....

Town..... State.....

R. R. or Co.....

Position.....

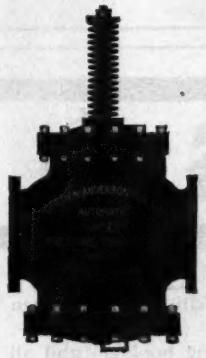
Keep a Uniform Stage of Water in Your Tanks

Stop wasting water and keep a constant head on your distribution system by equipping all reservoirs, stand pipes and tanks with

GOLDEN-ANDERSON PAT.

Automatic-Cushioned Controlling Altitude Valves

1.—Insure uninterrupted service and a positive water supply at all times.
2.—Prevent waste due to over-flow.
3.—Contain no floats or fixtures.
4.—Absolutely cushioned by both water and air in opening and closing. No banging, water hammer or burst mains.
5.—Can be opened and closed from distant points by simple electric solenoid attachment if desired.
6.—Can be made to work both ways to close automatically on a single pipe line in case of a break.
7.—Heavy construction throughout.



GOLDEN-ANDERSON
Pat. Automatic-Cushioned Water Pressure Reducing Valves

1.—Maintain a constant terminal water pressure under all conditions.
2.—Positively cushioned by water and air in opening and closing.
3.—Valve closes slowly, eliminating all shock and water hammer.
4.—Can be furnished with electric feature to open valve to full area from distant points.

"Users tell me their equal is not made"

I believe that you, too, will be convinced of this fact after you investigate

Golden-Anderson
Pat. Automatic Float Valves

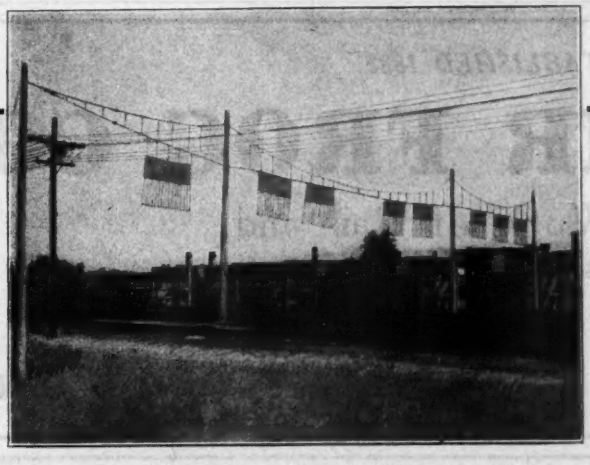
1. They are adjustable to operate either quickly or slowly.
2. Perfectly cushioned by water and air.
3. Equipped with swiveling blast.
4. Very heavy in construction.

Angle or Globe up to 24 in.

"HOSTS OF REFERENCES"

GOLDEN-ANDERSON VALVE SPECIALTY COMPANY

1290 Fulton Bldg. Water and Steam Specialties Pittsburgh, Penna.



Concrete Poles for Bridge Warnings

Massey Hollow Reinforced Concrete Poles readily adapt themselves as supports for bridge warnings.

Made by a special centrifugal process—they are light and have all the strength of steel poles, combined with the permanence, rigidity and lack of maintenance expense which characterize reinforced concrete.

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Pittsburgh Oliver Bldg.
Atlanta Candler Bldg.
Dallas Sumpter Bldg.
St. Louis Ry. Exch. Bldg.
Salt Lake City 925 E. 4th St., W.

The Frog, Switch & Manufacturing Company

Carlisle Pennsylvania

Established 1881

FROG AND SWITCH DEPARTMENT
MANUFACTURERS OF
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AND SPLIT SWITCHES
SOLID MANGANESE FROGS AND
CROSSINGS
PLAIN FROGS, SWITCHES, CROSSINGS
SWITCH STANDS AND ACCESSORIES

MANGANESE STEEL DEPARTMENT
MANUFACTURERS OF
"INDIAN BRAND"
HIGH GRADE MANGANESE STEEL CASTINGS
FOR FROGS, SWITCHES AND CROSSINGS
JAW AND GYRATORY CRUSHERS
CEMENT MILL; MINING MACHINERY, ETC.
GRAY IRON CASTINGS

DRILLS

FOR any kind of rock excavation, there is a Sullivan Drill exactly suited for most rapid, convenient and economical work, in railway maintenance or construction.

Ask for booklet 19,118

"Hyspeed" Piston drills for heavy, open cut tripod work;

Rotators for breaking boulders and all general drilling;

"DX-61" Water Drifters for rapid tunneling.

SULLIVAN MACHINERY CO.
411 Gas Building Chicago

ESTABLISHED 1882

THE WEIR FROG CO.

Track Work of Rail and
Manganese Steel Construction

Manufacturers of Balkwill Articulated Cast Manganese Crossings

CINCINNATI - - - OHIO

ST. LOUIS FROG AND SWITCH CO.

TRACK WORK OF QUALITY

Manufacturers of Balkwill Articulated Cast Manganese Crossings

We are pleased to send our 280-page Catalogue on request. Address Dept. M, St. Louis, Mo.

MODERN vs. PRIMITIVE

AS the modern Pacific Type Locomotive is to the once famous DeWitt Clinton, so is Hipower to the Plain Coil Nut Lock—a development in basic design to meet the exacting requirements of modern service.

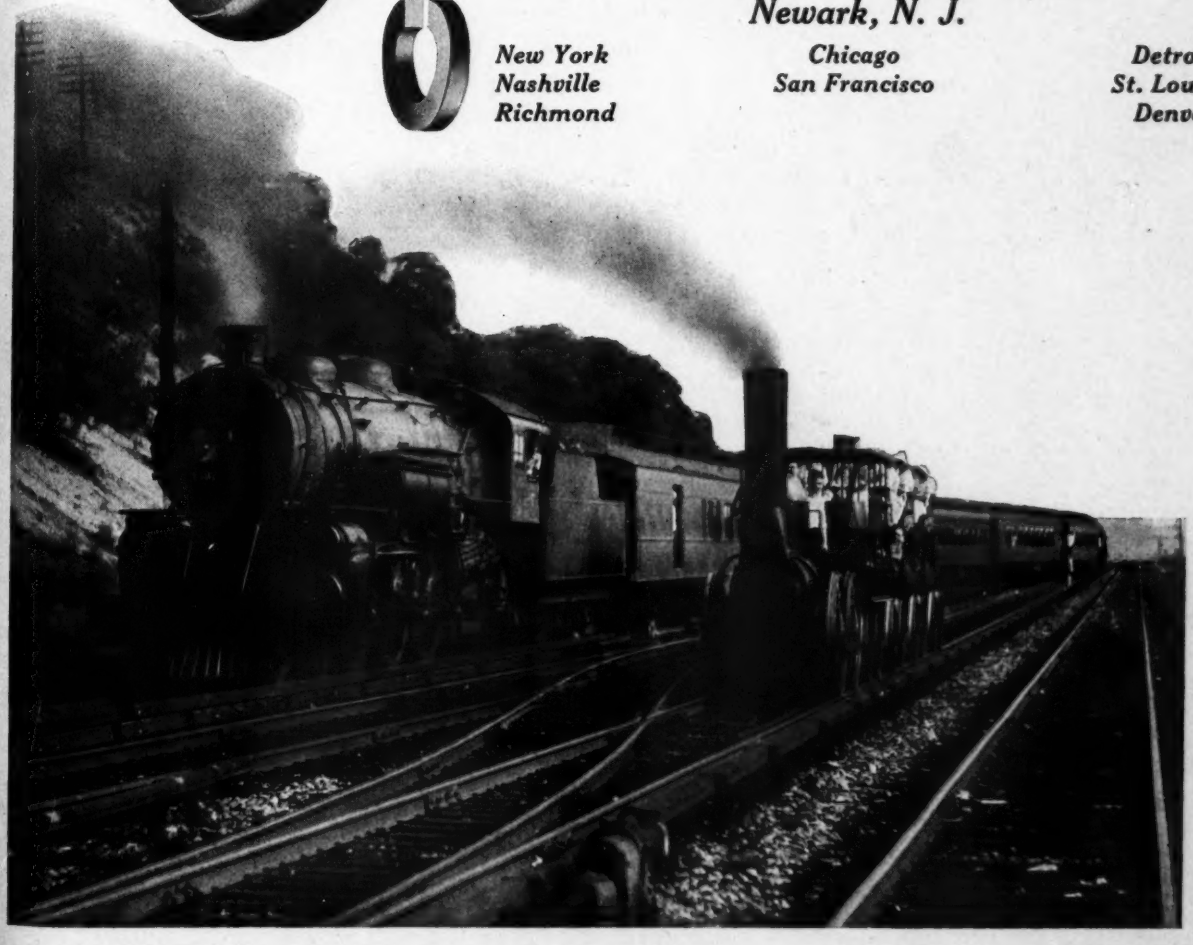
The Hipower Nut Lock is a natural, reasonable and mechanical development in railway track fastenings—a development prompted by railway engineers; conceived, produced and perfected by the oldest manufacturer of Nut Locks in the world and welcomed by every trackman whose good fortune it has been to use the device and appreciate its ability to effectively and permanently maintain the bolted security of track joint parts.

The National Lock Washer Co.

Established 1886

Newark, N. J.

New York *Chicago* *Detroit*
Nashville *San Francisco* *St. Louis*
Richmond *Denver*



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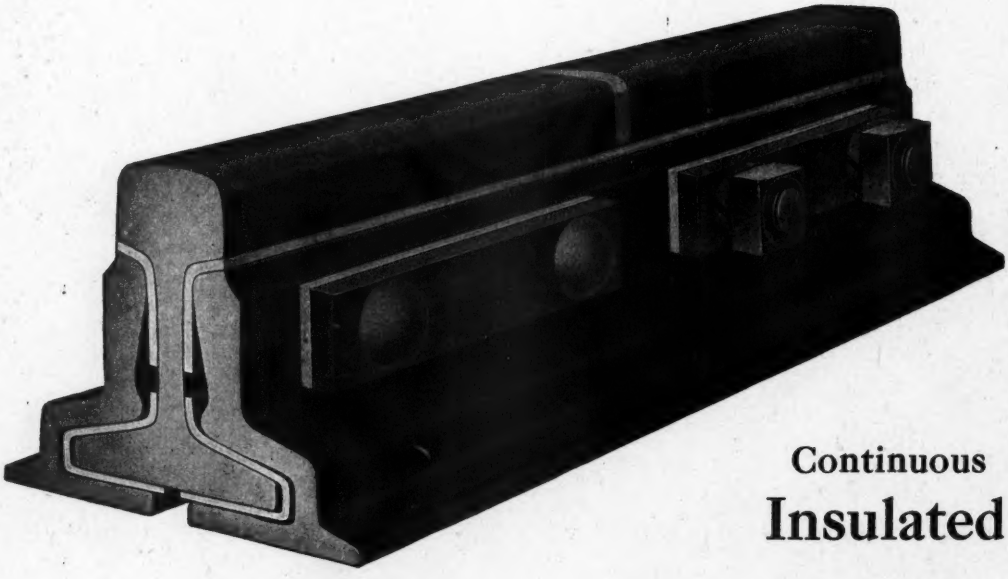
Continuous
Standard

Safety—Durability—Economy



Continuous
Insulated

The Rail Joint Company

61 Broadway **New York City**